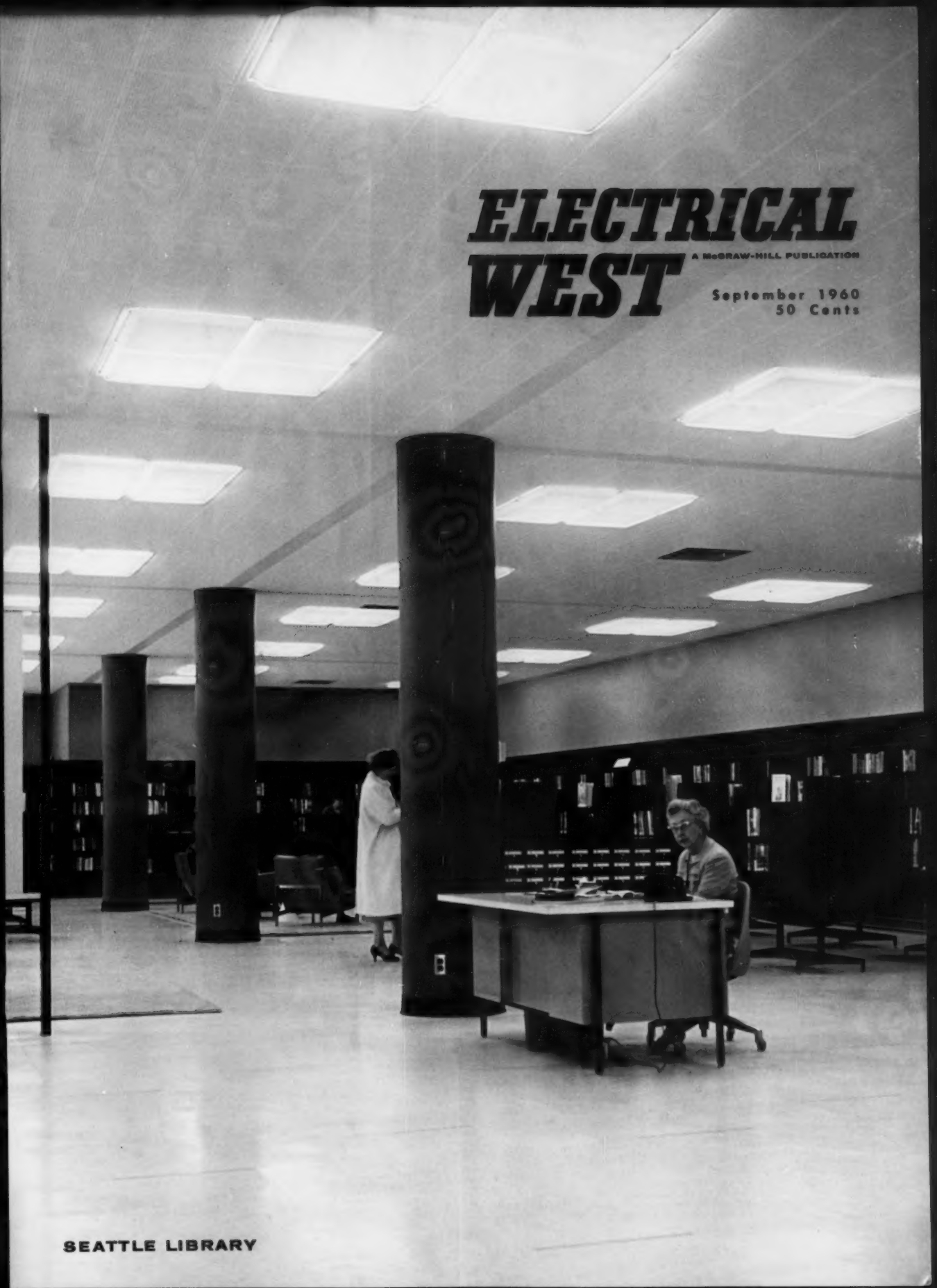

ELECTRICAL WEST

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September 1960
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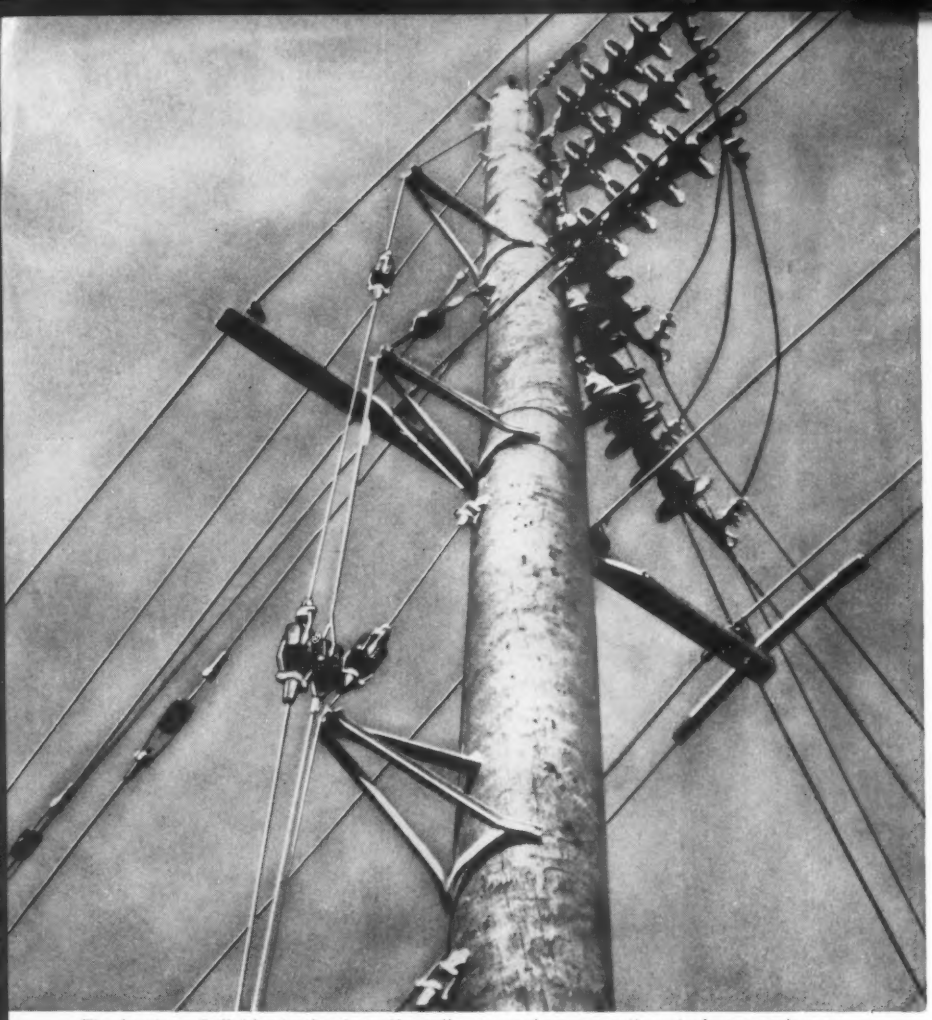
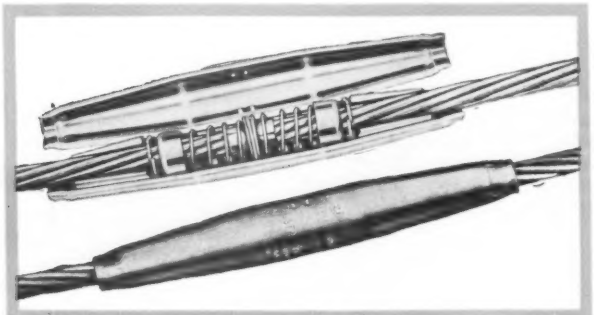


The fourteen Reliable deadends on these lines saved someone three to four man-hours.

TO THE EXECUTIVES IN CHARGE OF SAFETY... AND COSTS

During more than 25 years of continuing production, it has never been reported that a Reliable Feed-Thru Deadend chuck let go a line.

Feed-Thru Deadends are ideal for all working conditions. There are no special tools, no nuts, no bolts, no keepers . . . when the work is "hot" they get your men off the lines in the least possible time.



Reliable produces splices that perform like two deadends back-to-back. The conductor feeds completely through the chuck until it reaches the built-in center barrier.

Reliable

ELECTRIC COMPANY • FRANKLIN PARK, ILLINOIS

A Symbol of Integrity Since 1909

editorial views EW

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CULTIVATE FOR A LIGHTING HARVEST

After a break-through to any frontier, there has to follow a clearing and cultivation of the land before any crop can be raised. This pattern applies to any and all break-throughs. The pioneering done there must follow cultivation. Else what good is it?

So with lighting. For the less than 100 years that electricity has been employed to produce light, constant pioneering has been needed. The frontiers of darkness had to be breached. The goal was always "to provide the equivalent of outdoor sunshine indoors."

While illuminating engineers felt that such an optimum was necessary, they still lacked proof to back up their projections. And the doubting public, used to half-seeing in dark interiors—from cave days to those of a modern night club—had to be shown.

Research has provided that proof now. The actual need for lighting levels that make the seeing tasks of modern civilization bearable have been found by patient testing and the data have been recorded. From such data new recommended standards for interior illumination have been established.

Now must come the cultivation of the new frontier. Those who would sow to reap the promised crops must do so with great skill. Such skill must match that of the research that has provided them their opportunity.

As with every culture, it is not enough to reach a certain point. To earn the "crop" or reward, quality must be developed along with raw quantity. Else what results may well be "weeds."

Just great quantities of foot-candles of light may prove as obnoxious as weeds in a garden. And as profitless. Thus it behooves those in any way linked to lighting that they turn back now to cultivating the quality of the lighting crop they have sown, if they are to harvest satisfaction from their labors either for themselves or more importantly, if they want to survive, for their customers, the users.

Producers of the materials with which to generate light come forth with new and more efficient devices and sources almost faster than the industry can "break them to the plow." Often this leads to cascading torrents of raw light into or onto a place that may need light. Let it not be done heedlessly, without control and thoughtful application. Greater volume of light must be applied with more knowledge and skill than was permissible with less light.

Lest the public react again to too much light in the wrong manner and retreat as it has done repeatedly to a more comfortable gloom, those whose livelihood is linked with the sale of lighting must temper their approach. They must learn to use light with skill, even delicacy in many applications.

It is to such cultivation of this new frontier of lighting that this issue is dedicated. Its content counsels in ways to apply the knowledge of illumination to today's tasks. Both theory and practice are represented. There is much to be gained from the examples shown, design ideas that can find wider application.

Seattle Library—57

Visibility . . . on Streets—69

Ultrasonics—New Tool—70

The Cover

Pleasing color, comfortable lighting and air conditioning make the reading rooms of the new Seattle Library an inducement to reading. Details of its lighting design are given on pages 57-59. Cover photo by W. A. Cyr.

ELECTRICAL WEST

SPOKESMAN FOR THE MOST HIGHLY ELECTRIFIED REGION OF THE U. S. Established 1887

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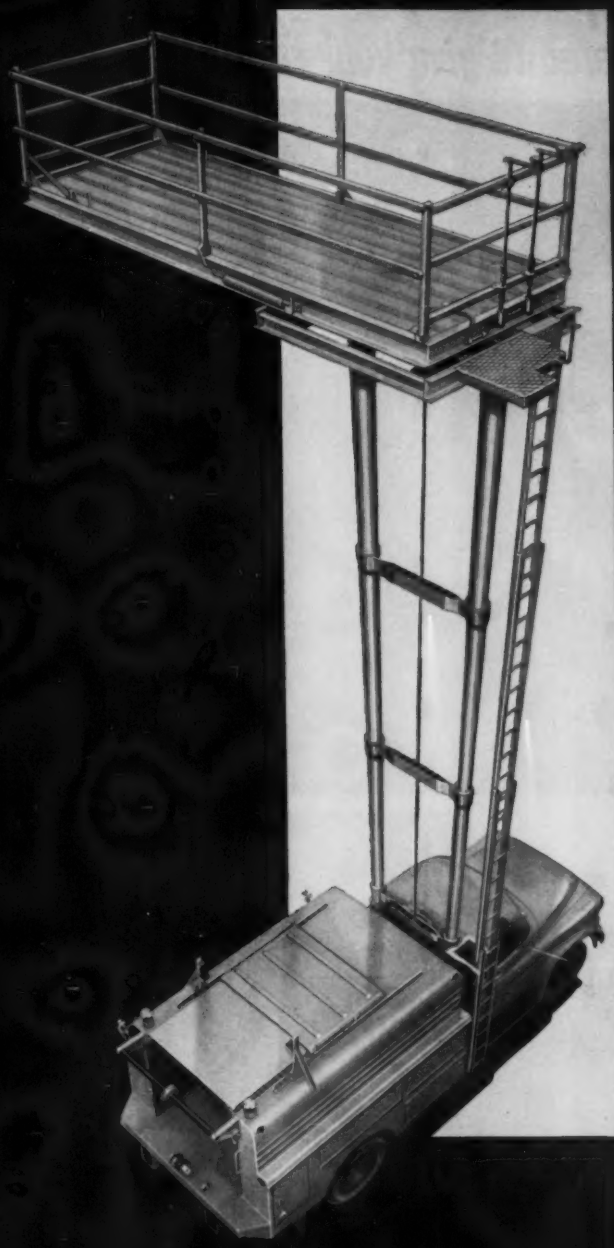

WORKSHOP WITH A 35 FT. REACH

POWERS-AMERICAN
HYDRAULIC
AERIAL TOWER

There's 44 sq. ft. of work space on the insulated platform of the Powers-American Series TW-2 Hydraulic Aerial Tower. Plenty of elbowroom for the overhead crew plus tools and materials.

Two perfectly-synchronized powerful hydraulic cylinders do the lifting work . . . elevate the platform to any height, up to its maximum reach which enables the crew to work 35 ft. above ground. Dual controls permit operation of the tower from the platform or the truck cab. Platform can be rotated continuously in either direction . . . enabling the crew to reach work in an area of 250 sq. ft.—without moving the truck.

The work-speeding, cost-cutting advantages of the TW-2 Tower can be combined with a Powers-American Body that's just right for your particular operation.

Descriptive literature and price information is yours for the asking.

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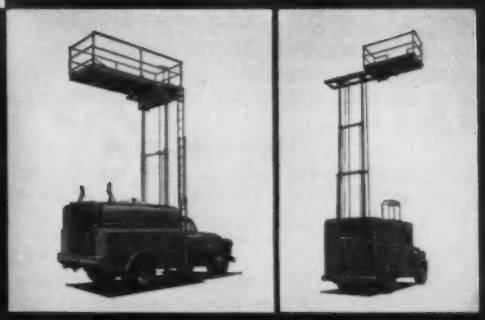


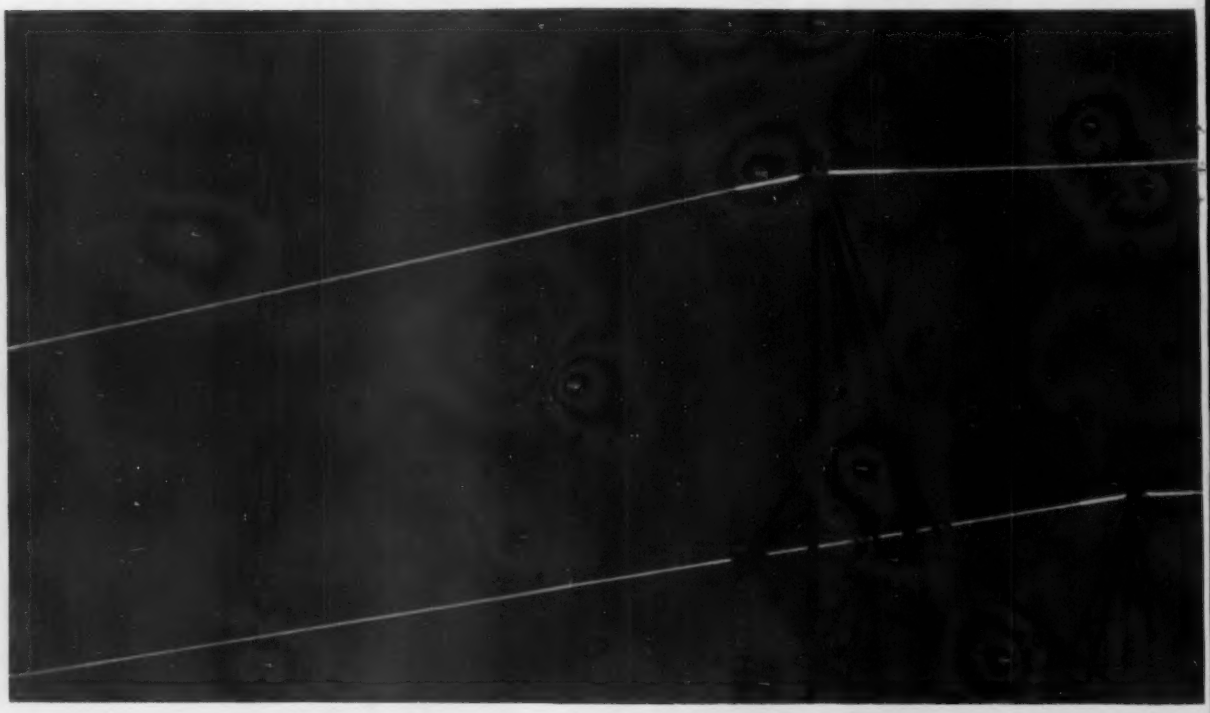
Series 7A-01 Tower (at left) is available in 21' and 25' models. Powers-American Towers can also be furnished with lateral-extending platform (at right), with stationary platform, or with special platform and operating features to meet your specific job needs.

Another reason why
UTILITIES EXPECT MORE FROM

POWERS *American*

UTILITY BODIES AND EQUIPMENT

Engineered to give your transmission lines



HERE'S WHY

ALUMOWELD OVERHEAD GROUND WIRE

IS THE MOST EFFECTIVE SHIELDING

FOR YOUR TRANSMISSION LINES

thick aluminum covering

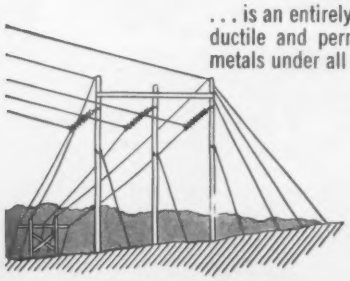
. . . provides 3 times the conductance of steel wire and the same corrosion resistance as solid aluminum wire. Alumoweld's heavy cladding of aluminum—25% by area—will not crack, flake or peel.

strong steel core

. . . gives Alumoweld the same rugged strength as extra-high-tensile steel wire, yet Alumoweld is 18% lighter in weight.

controlled atomic weld

. . . is an entirely new process which results in a ductile and permanent weld between the two metals under all operating conditions.



ALUMOWELD FOR GUY STRAND

Because Alumoweld is strong, easy to handle and will not rust, it is ideal for guying purposes.

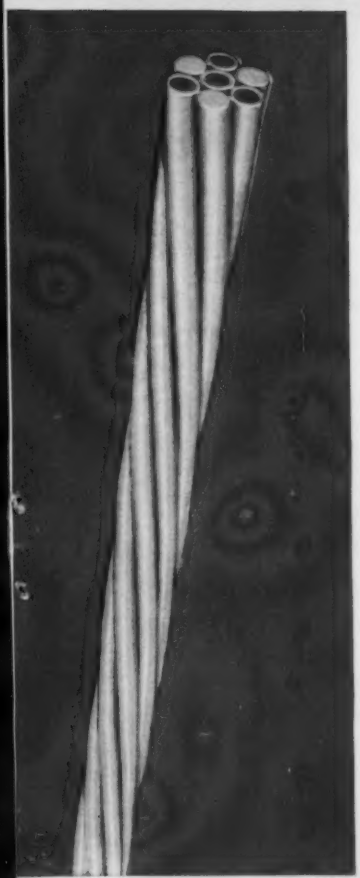
Alumoweld is available for immediate delivery from our warehouses located in New York, Chicago, Pittsburgh and Memphis. Let us quote on your requirements for this low-cost strand.

BETTER PROTECTION—LONGER LIFE—at LOW COST...

NEW

ALUMOWELD

overhead ground wire



Alumoweld Overhead Ground Wire is in a class by itself! In addition to its superior mechanical and electrical properties, this new aluminum-covered steel wire offers the money-saving benefits of low original cost and lowest maintenance cost.

Having the rugged strength of extra-high-tensile steel wire, Alumoweld is 18% lighter in weight . . . has three times the conductance . . . and will last far longer. When compared to solid aluminum wire, Alumoweld has equal life, one third the conductivity, and eight times the strength.

Here's why Alumoweld pays off when used for overhead ground wire. Its high strength-to-weight ratio permits stringing with small sags for greater mid-span clearance. The excellent conductivity of Alumoweld assures proper operation of protective relays and effectively discharges lightning currents to ground. This greatly improves the stability and dependability of the system. Equally important is the long, trouble-free life that Alumoweld provides because of its ability to resist corrosion.

Engineering bulletin E.D. 3000 will bring you the complete story. Write for your copy today.

ALUMOWELD

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION
Glassport, Pa.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

For phone number of closest representative see advertising index in back of book.

Three-way freeway Y near Casa Grande is brightly lighted by Weld-Rite B-3012D (foreground), and A-306 and A-308 poles, 30 ft. high. Planning and supervision by H. Stead, traffic supervisor Arizona Highway Dept.

Slender, double-armed Weld-Rite 30 ft. B-3015TD standards light the way in to Tucson. Installed jointly by Pima County and City of Tucson. A. E. Magee, electrical engineer.

Tourist trade and local business thrive where attractive lighting promotes easy viewing and safety. Where you install graceful Weld-Rite lighting standards, as this state and city do, you've made a life-time installation, because—

They're strong. Weld-Rite standards are die-formed from full 10-gauge steel. Every pole meets EEI-NEMA specifications. They resist weather. Your choice of dip painting inside and outside by our exclusive process, or hot-dip galvanized.

You get quick delivery to meet tight job schedules, because we manufacture in the West. Hundreds of Western installations. Pictures and fully illustrated catalog of standards for freeways, streets, parking and recreational areas, traffic signals, etc., yours for the asking. Write or phone now.

WELD-RITE COMPANY

Only active manufacturers of round tapered steel poles in the West.

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9

ARE YOU TAKING ADVANTAGE OF THE ADDED KVA CAPACITY OF GENERAL ELECTRIC'S 55°◎65° DISTRIBUTION TRANSFORMERS?

GENERAL ELECTRIC

55° 65°
75/84
37.5/42
50/56
100
112
15/16.8
5/5.6
10/11.2
25/28

Why settle for less, when . . .

General Electric Transformers give you added KVA, with the same operating life– at no price premium

Major insulation development provides 12 percent more kva capacity. Here are the facts . . .

General Electric's complete line of oil-filled **55°⊙65°** distribution transformers provides 12 percent more kva capacity—at no price increase or loss in normal operating life. This added capacity is made possible by using Permalex* insulation—a major innovation in transformer insulation systems which was developed by General Electric and is used in oil-filled distribution transformers.

The use of superior Permalex insulation permits transformer operation at higher average winding rise (65 C) without loss of normal operating life. This means you can carry 12 percent more kva with General Electric Permalex insulated transformers.

Every General Electric **55°⊙65°** transformer has a second nameplate kva rating. The new, higher rating reflects the 12 percent kva increase—allowing you to utilize the added capacity within your established loading practices. *And the new rating retains the same design margin between stated temperature rise and actual rise—consistent with traditional General Electric distribution-transformer design practices.*

*Trademark of General Electric Co.

General Electric's new approach to greater kva capacity is accomplished through advanced interior transformer design. Permalex transformers retain the same small size and light weight—but with substantially increased kva capacity.

Before you buy another transformer, ask your G-E Sales Engineer to show you the story of the **55°⊙65°** transformer. It takes just a few minutes and can save you many dollars in transformer investment and operation. Or, write for more information to Section 482-08, General Electric Co., Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

COMPLETE LINE OF 55°⊙65° POLE-TYPE TRANSFORMERS now available from G-E warehouses across the country. Instrumental in the development of this new transformer design were Dr. R. Flowers, insulation laboratory chemist and co-inventor of patented cyanoethylated kraft; J. Silverstein (front), Product Planning Specialist; and J. Leslie, insulation laboratory chemist.

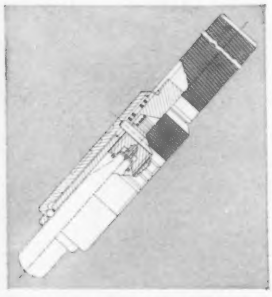
For phone number of closest representative see advertising index in back of book.

LOW COST LABOR-SAVER for EVERY CONTRACTOR!

Completely NEW

JET LINE GUN!

Fast, safe, easy to use... for all large conduit from 1¼" thru 6"



DETAIL DRAWING SHOWING CONSTRUCTION OF GUN

ACTUAL SIZE

Small enough to carry in your pocket!

Cartridge in place for launching

NOW ONLY $24.50

COMPLETE NO. 1110 KIT

(Jet Line Gun Only, $19.50)

Kit contains: **New Jet Line Gun • Line Can, Nylon Line • Jet Line Cartridges • Nylon Line Packages • Line Can and Package Holder • Cartridge Nose Cone Extensions • Extra Needles**

1. Tie nylon line to cartridge and insert in Gun.
2. Push cartridge all the way back—hard—to puncture and lock in place.
3. Set cartridge into the conduit and release by pushing large barrel forward with thumb. One click does the trick!
4. Over 125 ft., use line package which reduces pull and lays a line as it goes.

RUGGED • POSITIVE ACTION TROUBLE-FREE • COMPACT

This entirely *new*, improved Jet Line Gun costs only *one third as much* as the former model! No contractor can afford to be without it!

The new Jet Line Gun launches a self-propelled cartridge that lays a strong nylon line through large size pipe in *seconds*. Save *hours* on conduit wiring jobs. Distances up to 600 ft. Your Jet Line Gun pays for itself over and over again! The new Jet Line Gun . . . and the Jet Line Cylinder system for small conduit, gives you a new method that can save you up to 70% of your wire pulling costs.

**Pat. #2,930,584*

Use the Jet Line Cylinder System for small conduit—½"- ¾" - 1"

Ask your distributor or write

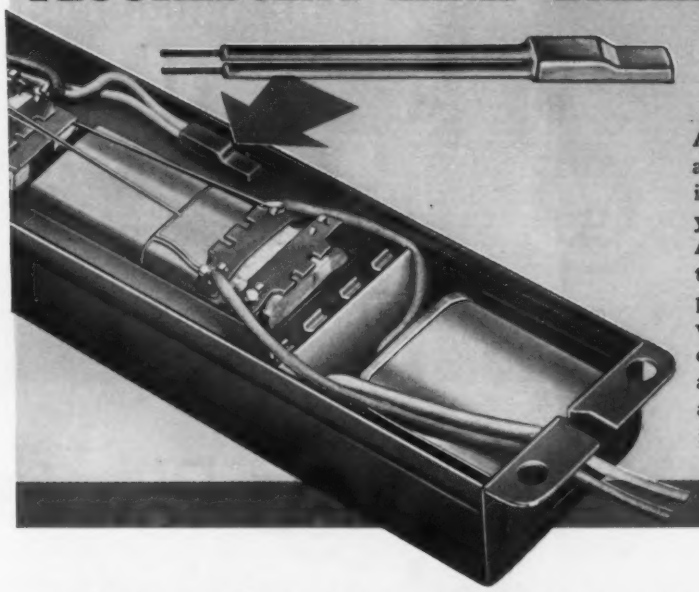
JET LINE PRODUCTS, INC.

615 FUGATE AVE., CHARLOTTE 5, NORTH CAROLINA

PROTECT FLUORESCENT LIGHTING INSTALLATIONS

with ADVAN guard®

FLUORESCENT LAMP BALLASTS



ADVAN-guard,® a thermally actuated automatic reclosing protective device, introduced by ADVANCE almost 3 years ago, is an integral part of every ADVAN-guard® Ballast. It is sensitive to voltage and current as well as temperature and protects against excessive voltage supply . . . internal ballast short circuiting . . . inadequate lamp maintenance . . . improper fixture application and eliminates the need for individual fixture fusing.

ADVAN-guard® is sealed in the ballast housing and pre-set to instantly and automatically trip out whenever the ballast is operating at higher than recommended temperatures. When heat decreases to normal operating temperature, ADVAN-guard® resets automatically and the ballast resumes operation, adding years to ballast life by preventing ballast operation at abnormal temperatures. To assure maximum protection for fluorescent lighting installations, provide ADVAN-guard® Fluorescent Lamp Ballasts. ADVAN-guard® is listed by Underwriters' Laboratories, Inc. Write for detailed literature.

"The Heart of the Lighting Industry"

ADVANCE®

CBM CERTIFIED

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

TRANSFORMER CO.

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

Manufactured In Canada by: ADVANCE TRANSFORMER CO. Ltd., 5780 Pare St., Montreal, Quebec, Canada

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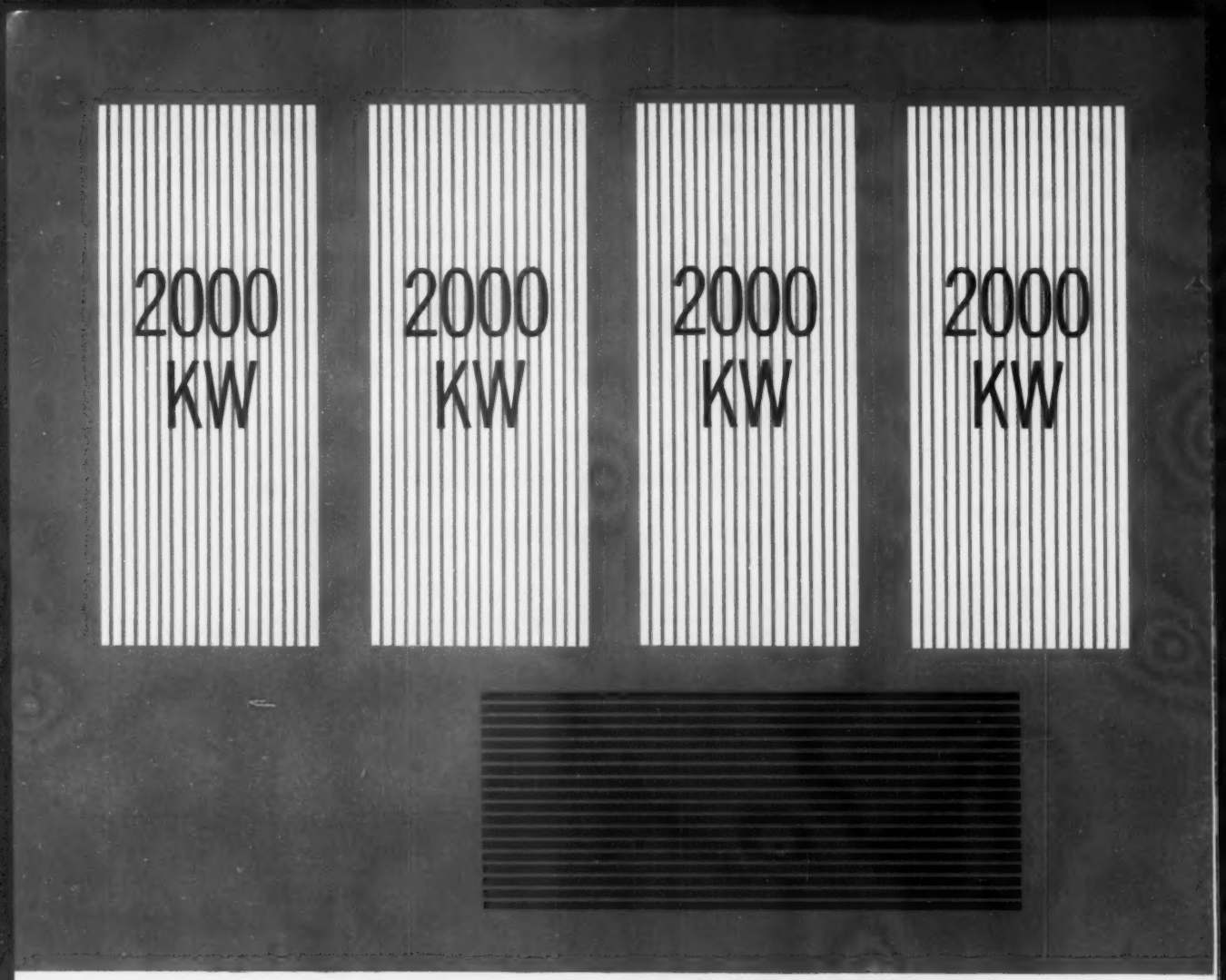


Electro-Motive Peaking Plants

New MU-100 plant $82 per KW, F.O.B. Electro-Motive Factory

For those utilities seeking higher capacity peaking power, the new Electro-Motive 10,000 KW plant offers low investment per KW (as low as $94 per KW installed at site) plus new operating and control features not found on other types of equipment.

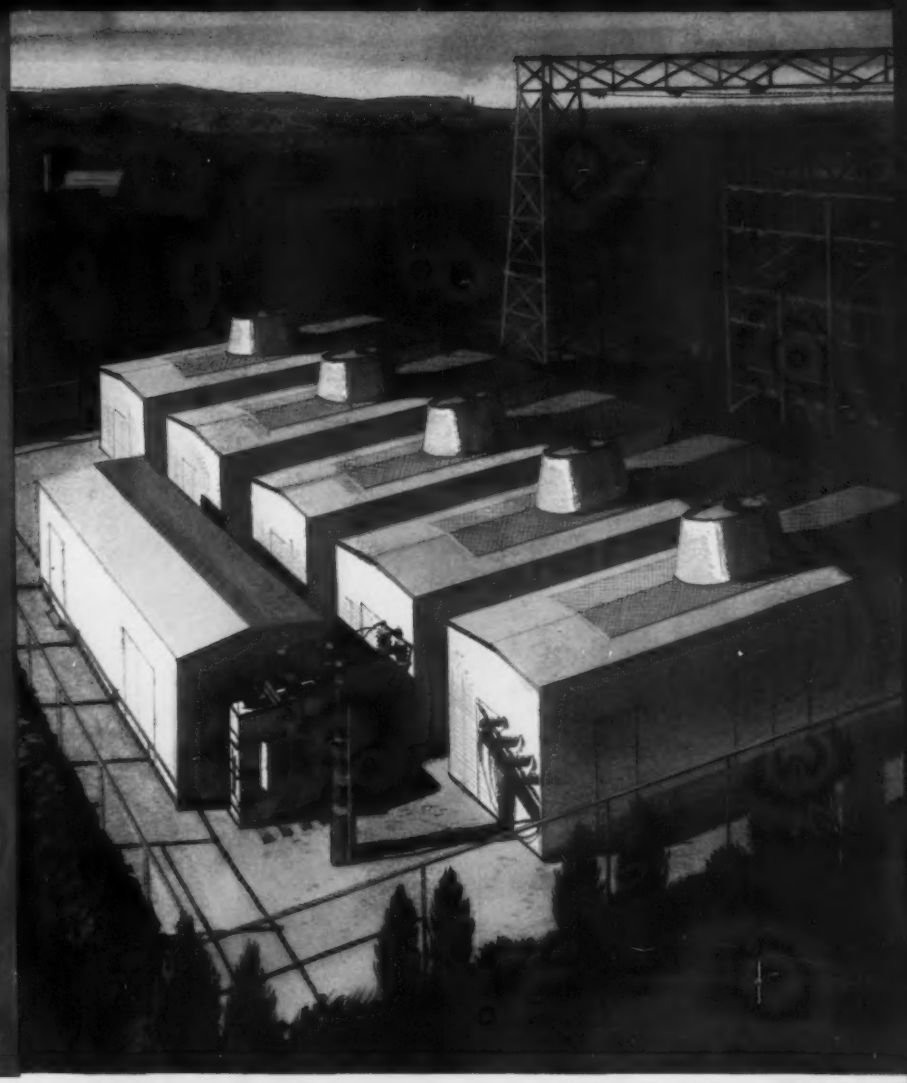
Highly flexible. The MU-100 may be utilized in peaking, reserve or area protection applications. It may be remotely operated by a variety of methods—automatically by voltage or current sensing devices, and by supervisory control such as leased telephone line or by carrier current. Self-contained design permits location at the step-down substation serving the load. Installation is simple and inexpensive, and the plant may be moved at any time to match changing load conditions.

Future expansion flexibility. Smaller Electro-Motive plants (2,000, 4,000, 6,000 and 8,000 KW) can be installed now with control equipment in place to expand later up to 10,000 KW.

By taking advantage of this plan-ahead feature, additional KW capacity can be added later for less than $75/KW *installed*. For example, total end cost for uprating from 2,000 KW to 8,000 KW is the same as the initial cost for an 8,000 KW plant.

New controls. The plant control contains many innovations which further extend flexibility. The plant may be operated remotely at various capacities to match load conditions. Each generator produces 2,000 KW—and each may be operated individually or

NOW + 2000 KW



now available up to 10,000 KW

in any combination. Thus, the plant will provide 2,000, 4,000, 6,000, 8,000 or 10,000 KW. With selective control a block of power is always available—even during maintenance.

Fast start. From a cold start, the MU-100 is on line carrying load in less than three and one-half minutes. A spinning reserve start has been designed into the plant which reduces starting time to a minute and a half.

With the addition of the MU-100 to the Electro-Motive line, the most complete range of capacities is available in specialized peaking equipment. Thus it is possible to match capacity to need for the most efficient operation and lowest investment. An increase in demand is handled by expanding the plant—at low incremental cost—with additional generating components.

An analysis of utility peaking needs will reveal the savings possible with the application of Electro-Motive equipment. Ask the Electro-Motive representative for information.

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GENERAL MOTORS · LA GRANGE, ILLINOIS

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MU-14DF 1000 KW Dual-fuel

MU-40 4000 KW Diesel
MU-28DF 2000 KW Dual-fuel

MU-60 6000 KW Diesel
MU-42DF 3000 KW Dual-fuel

MU-80 8000 KW Diesel
MU-56DF 4000 KW Dual-fuel

MU-100 10,000 KW Diesel
MU-70DF 5000 KW Dual-fuel

NEW 800 "PLUS" FLOOR BOXES

Here's A Floor Box That Takes The Full Range Of Receptacles

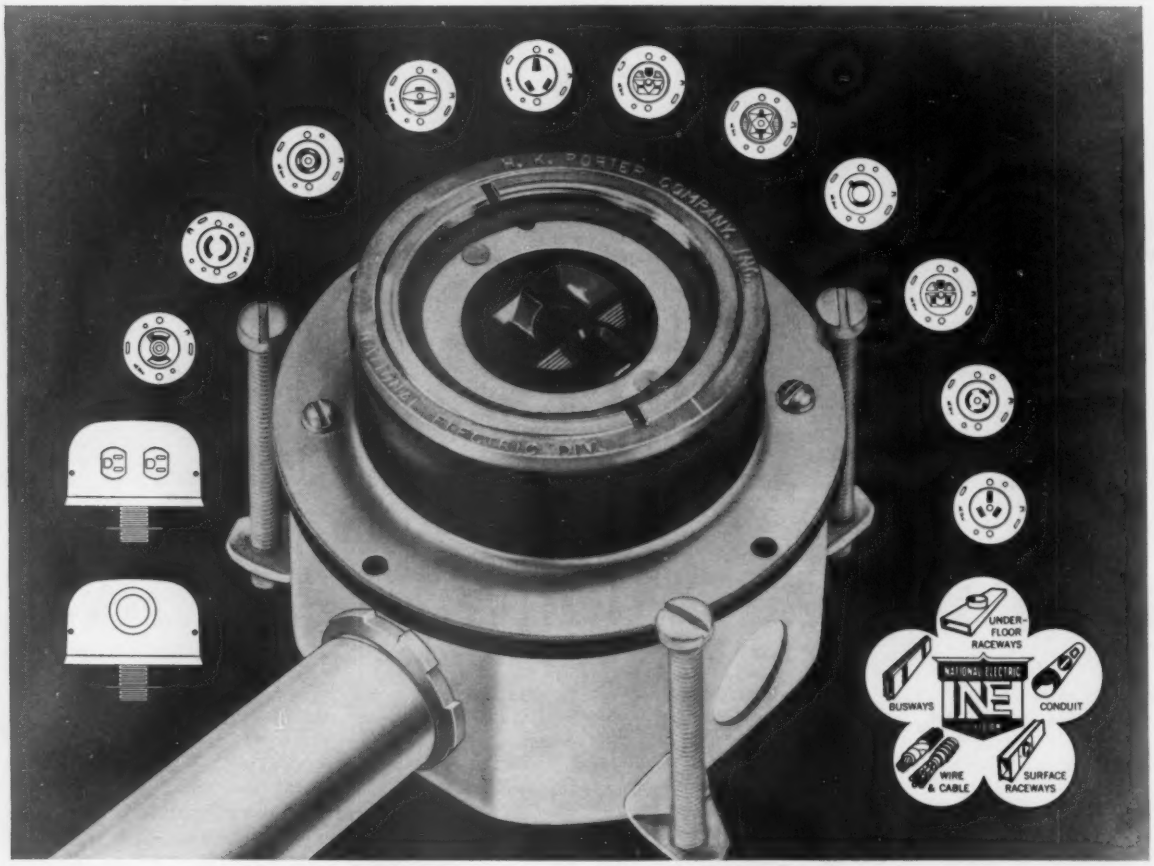
ALL THE ADVANTAGES OF THE 800 FLOOR BOX

"PLUS" Accepts widest range of flush floor receptacles through 20 amps—standard service fittings taking receptacles through 50 amps.

"PLUS" Larger hand-hole for easier fishing.

"PLUS" Mounting ring for easy field installation of intercom and low potential jacks.

"PLUS" Accepts all standard attachment plugs.



All of these plus values have been incorporated in the new 800-"Plus" Floor Box with no increase in price, and without sacrificing any of the quality features of the original box. Leveling adjustment has actually been increased . . . gasket provides positive water-tight seal . . . floor plate now accommodates ½, ¾ and 1 inch conduit . . . and both the 1½ and 2⅛ inch deep bodies offer a wide range of knockouts.

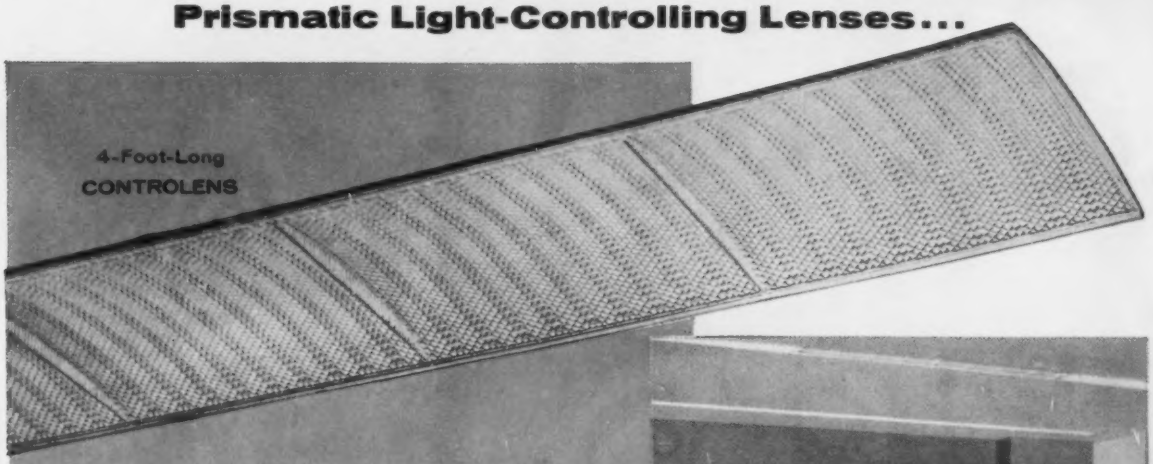
Ask your N-E Man for full information on the floor boxes that were developed to meet the specifications of contractors and engineers, or write for complete, descriptive literature. *National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pennsylvania.*

NATIONAL ELECTRIC DIVISION PORTER **H. K. PORTER COMPANY, INC.**

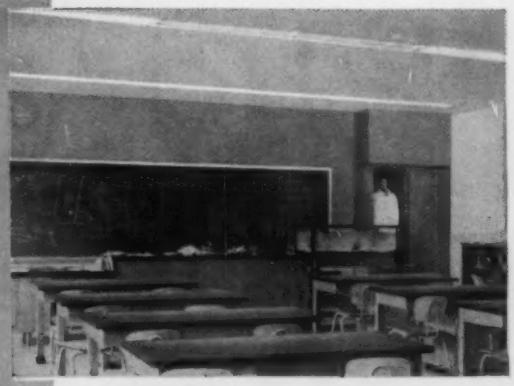
PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

For phone number of closest representative see advertising index in back of book.

ACRYLIC PLASTIC...The Proven Material for Modern, Prismatic Light-Controlling Lenses...

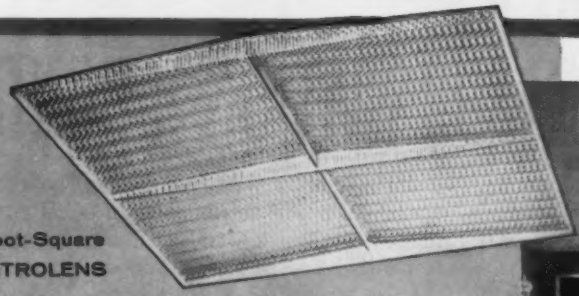


Wherever the PRISMALUME CONTROLENS has been used it has delivered consistently superior performance: high level illumination with the utmost visual comfort. Its prismatic construction provides effective light control with the best "hiding-power" to conceal light sources. The use of crystal-clear acrylic plastic produces a CONTROLENS that is light in weight, shatter-resistant, free from discoloration and altogether different in its distinctive, quality appearance. Reinforcing struts assure great dimensional stability... Available in a variety of shapes for a wide range of fluorescent applications.



4-Foot-Long CONTROLENS, singly or in continuous runs, are advantageously used in classrooms, offices, banks, showrooms, libraries, stores, lobbies and laboratories.

HOLOPHANE PRISMALUME® CONTROLENS®

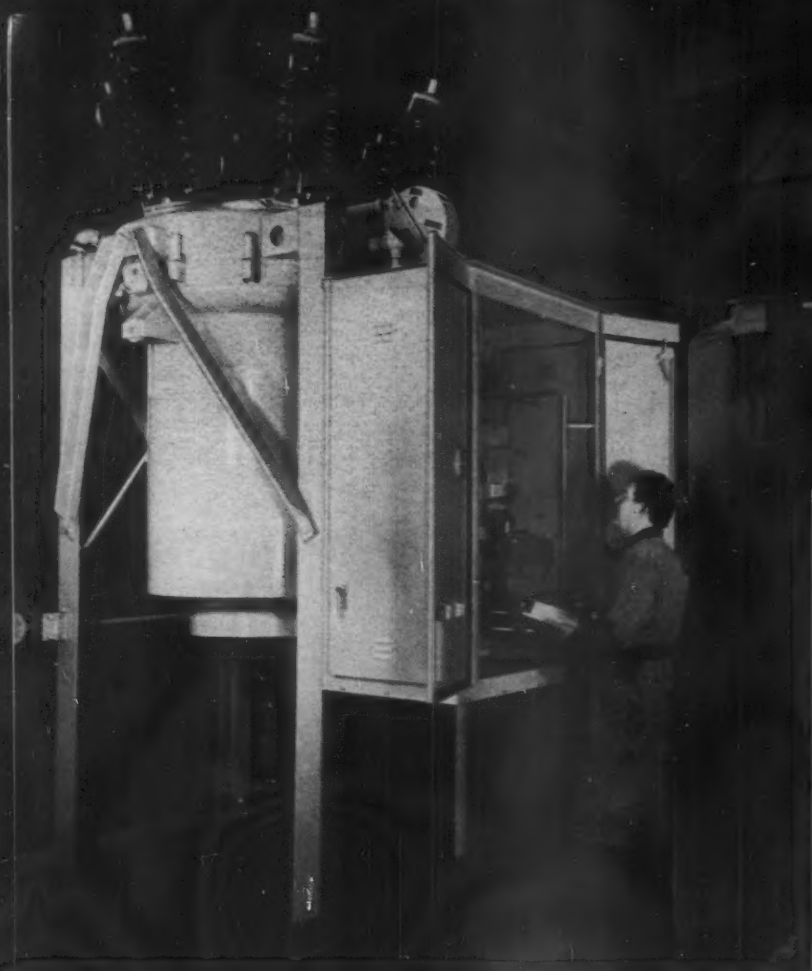


The flexibility of the 2-Foot-Square CONTROLENS makes it adaptable in many ways, such as: • Geometric groupings (one or more lenses)... • 2-ft-wide continuous troffer runs... • Large luminous panels.

Write for Engineering Data

HOLOPHANE COMPANY, INC.
Lighting Authorities Since 1898
342 Madison Ave., New York 17, N. Y.
THE HOLOPHANE CO., LTD., 418 KIPLING AVE. SO., TORONTO 18, ONT.

For phone number of closest representative see advertising index in back of book.



- Only One Tank to Lower
- Easy Access to all Internal Parts
- From 30 to 80 Gallons Less Oil
- Saves 20% Maintenance Time

NEW I-T-E TREND-LINE BREAKERS SET THE PACE FOR SUBSTATION ECONOMIES

I-T-E, the foremost U.S. manufacturer of switchgear and power interruption equipment, announces an exciting new line of outdoor power circuit breakers—the I-T-E TREND-LINE. Now, substations may employ single-tank breakers in subtransmission ratings with complete confidence in the reliability and performance.

Incorporating a new KOOL-ARC vertical interrupter, these breakers deliver 5-cycle interrupting time as standard performance. Although all phases are contained within a single steel tank, adequate clearance and special tank liners and phase barriers ensure equal or better protection than that afforded by three-tank designs. The new single tank can be easily dropped by one man using an electric tank lifter. With only one tank to service and maintain, substation economies are realized that were previously impossible with the old three-tank designs.

For descriptive literature on the I-T-E TREND-LINE, write to 1667 North Main Street, Los Angeles 12, Calif., Dept. EWE-960-2.

I-T-E CIRCUIT BREAKER COMPANY
KELMAN POWER CIRCUIT BREAKER DIVISION

It may be old hat, but it wears well.

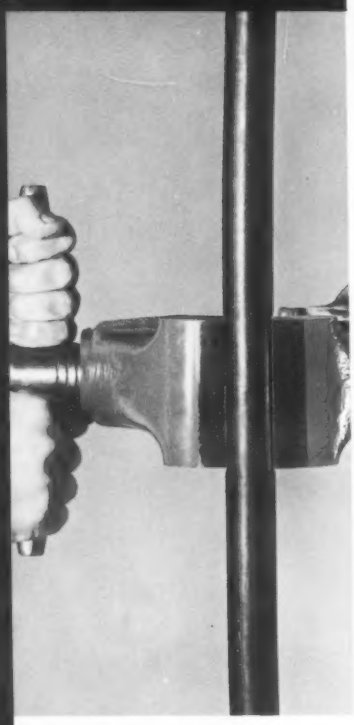
KERITE CABLE

it's the **KERITE** *that makes the difference*

General Office—30 Church Street, New York 7, N. Y.

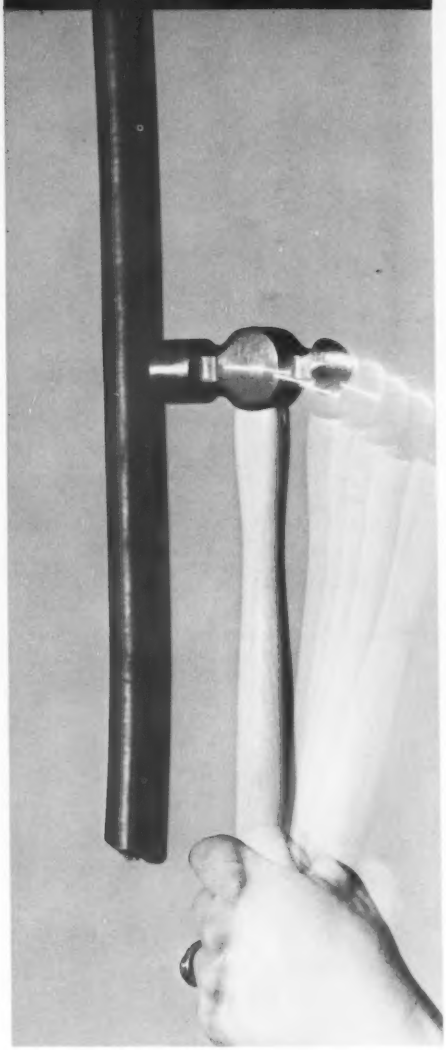
SALES OFFICES:
Albuquerque, Ardmore, Pa., Birmingham, Boston, Chicago, Cleveland, Denver, Glendale, Cal., Houston, Lake Wales, Fla., Portland, Ore., St. Louis, Salt Lake City, San Francisco, Seattle

Neoprene resists COLD FLOW



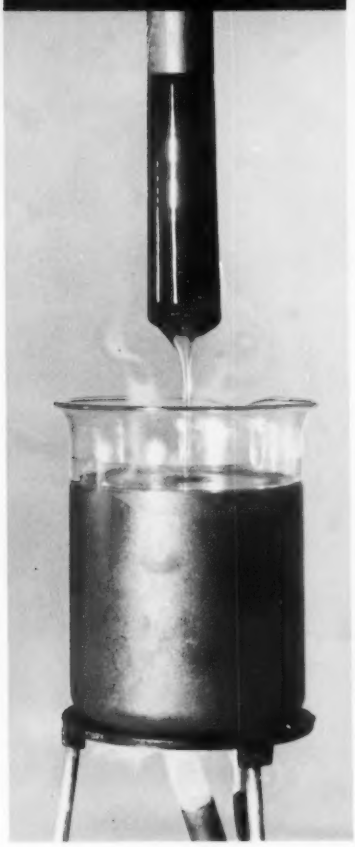
In laboratory tests and on the job, neoprene synthetic rubber has proved its ability to resist permanent deformation under load. It stays tough, resilient at high and low temperatures. Other cable jacketing materials get brittle when cold, soften when heated, flow when compressed. Not neoprene.

Neoprene resists IMPACT



Neoprene is a tough, resilient jacketing that can take impact and abuse. In the most severe mining service it has proved its ability to withstand abrasion . . . to resist gouging and tearing. It surpasses other cable jacketing materials in laboratory impact tests. It gives your cable the best protection available against abuse.

Neoprene resists HEAT . . . OIL



Neoprene jacketing resists exposure to oil, grease and a variety of chemicals and solvents. Its resistance to heat protects insulation at temperatures as high as 250° F. In addition, neoprene is flame resistant; it will not support combustion, an important factor among safety-conscious cable users in factories, refineries and mines.

Neoprene resists

SUNLIGHT...WEATHER

Installed January 6, 1935, these two test lengths of electrical cable have been exposed out of doors to rain, snow, sun, ozone and industrial fumes for over a quarter century. One jacketed with ordinary rubber (right) is badly cracked, furrowed, embrittled. But the neoprene jacket (left) is still sound, tough, resilient—still able to give complete protection to the cable.

Neoprene resists

SUB-ZERO COLD

In the arctic, neoprene synthetic rubber is used to protect radar domes—and you can use this cold weather durability in cable that must serve outdoors in frigid winter weather. Neoprene jacketing stays flexible and resilient at low temperatures ... successfully meets specifications for military cable designed for use at –65° F.

PROVED

IN A QUARTER CENTURY OF INDUSTRIAL SERVICE —THERE'S NO DOUBT ABOUT NEOPRENE JACKETING

For more information, write to: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. ET-9, Wilmington 98, Delaware.

DU PONT
REG. U. S. PAT. OFF.

NEOPRENE
SYNTHETIC RUBBER

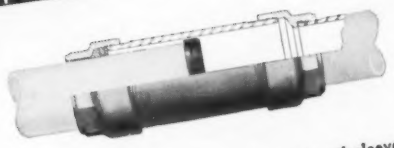
Better Things for Better Living . . . *through Chemistry*

in the long run... it's O.Z.

Type AX

Provides 4" expansion, contraction movement. Malleable iron head, body Hot Dip Galvanized. Weatherproof head sealed by factory-installed high grade graphite packing. Insulating conduit end bushing eliminates cable abrasion. 10 sizes for conduit ½" to 4" diameters.

Type EX



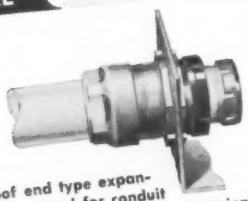
Permits 8" conduit movement. Optional length sleeves, additional cost. Weatherproof head sealed by factory-installed high grade graphite packing. Insulating bushings prevent cable abrasion. Hot Dip Galvanized finish. 12 sizes for ½" to 6" conduit diameters.

Type DX

Patented

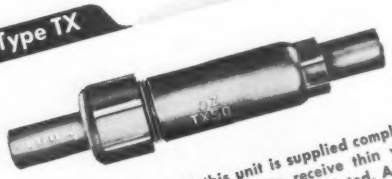
Compensates for deflection, expansion, contraction. ¾" movement all directions from normal; 30° angular movement. Also used as vibration damper between conduit sections. 10 sizes. Watertight (NEMA 4) and submersible under 25 ft. head of water.

Type EXE



Weatherproof end type expansion fitting. Designed for conduit terminating in junction box, where expansion, contraction take place. Supplied complete: locknuts, bushings. Standard finish, Hot Dip Galvanized. 12 sizes.

Type TX



Similar to the Type AX, this unit is supplied complete with extension nipples, ready to receive thin wall couplings. Standard finish is cadmium plated. Available in 6 sizes for conduit ranging from ½" to 2".

for the longer line of EXPANSION FITTINGS

In the long run, no line of conduit is more dependable than its components. When it comes to dependability in expansion fittings, look to O. Z. as the line that measures up! Five basic types provide the dependable answer to your fitting problems in conduit expansion, contraction, and deflection. O. Z. is the dependable line because it's the line with the *right size*, the *right type*, for every requirement! Types AX, DX, EX and EXE available in aluminum at no extra cost.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GArfield 1-7846

NEW SMALL MAGNETIC STARTER COSTS LESS, SAVES SPACE ON LOW-HORSEPOWER JOBS!

CLASS 8536

Square D NEMA Size 00 Starter Rated ¾ to 2 Hp for 3-Phase Service

• You no longer need to buy more starter capacity than you can use for low-horsepower jobs! This new Square D Size 00 starter is compact, easy to install, simple to use and maintain—and it costs 18% less than the Size 0 starter you formerly had to specify to get the advantages of magnetic control! With no sacrifice in quality, this new starter provides: straight-through wiring—pressure-type terminals—1-piece overload relays for complete motor protection—pushbutton or selector switch optional in the cover. Also available without overload relays.

GET THE COMPLETE STORY! Write for Bulletin SM-297. Square D Company, 4335 Valley Blvd., Los Angeles 32, Calif.

New starter is available either open or in NEMA Type 1 enclosure. Enclosure shown with selector switch in cover.

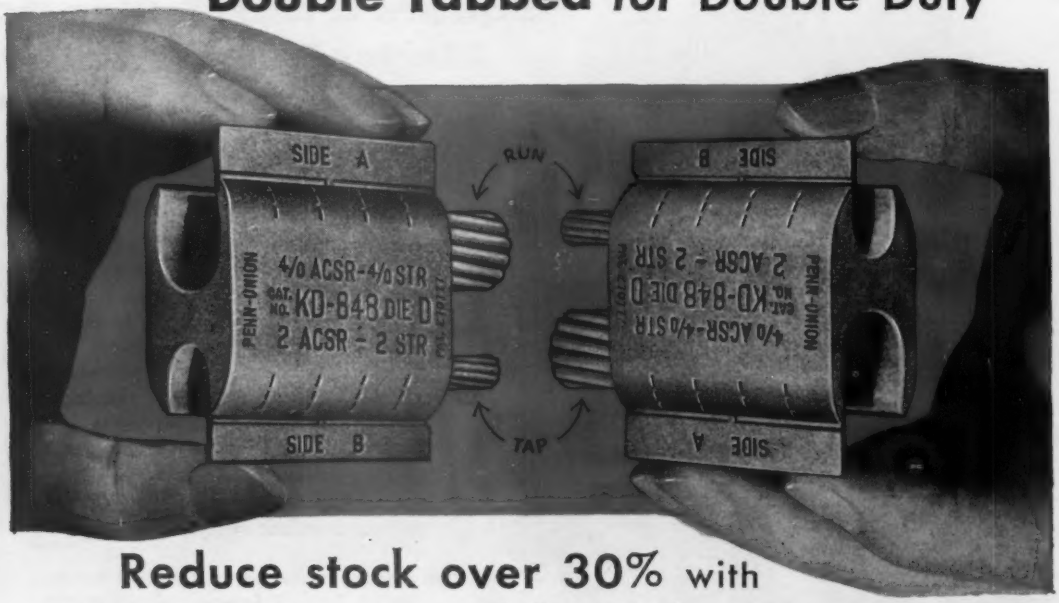
SQUARE D COMPANY

wherever electricity is distributed and controlled

For phone number of closest representative see advertising index in back of book.

REVERSIBLE

Double Tabbed for Double Duty



Reduce stock over 30% with

Penn-Union *Double-Tab* "Press-On"

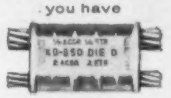
Less Stock— Reversible for dual application.

High Conductivity— E. C. Aluminum extrusions assure cool running high efficiency contacts.

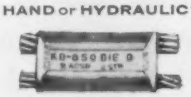
Easy Crimping— Fully annealed for easy installation— deep indent crimp lines.

Pre-Loaded Inhibitor— Cleaned contact surfaces kept free of oxide re-formation by non-dripping Penn-Union "Cual-Aid." In colored polyethylene bag printed with complete information.

Crimp with tools you have



HAND or HYDRAULIC



using O and D dies

Cu to Al— Heavy spacer provides conductor separation and prevents strand cutting. Also minimizes galvanic corrosion.

Weather-Protected— Full-length tab provides complete enclosure for inhibitor.

Cable Protection— Heavy chamfering of cable openings protects main and run.

The Complete Line— Double Tab cable sizes #6 through 4/0. Single Tab cable sizes to 400 MCM.

PENN-UNION ELECTRIC CORP., Erie, Pa.

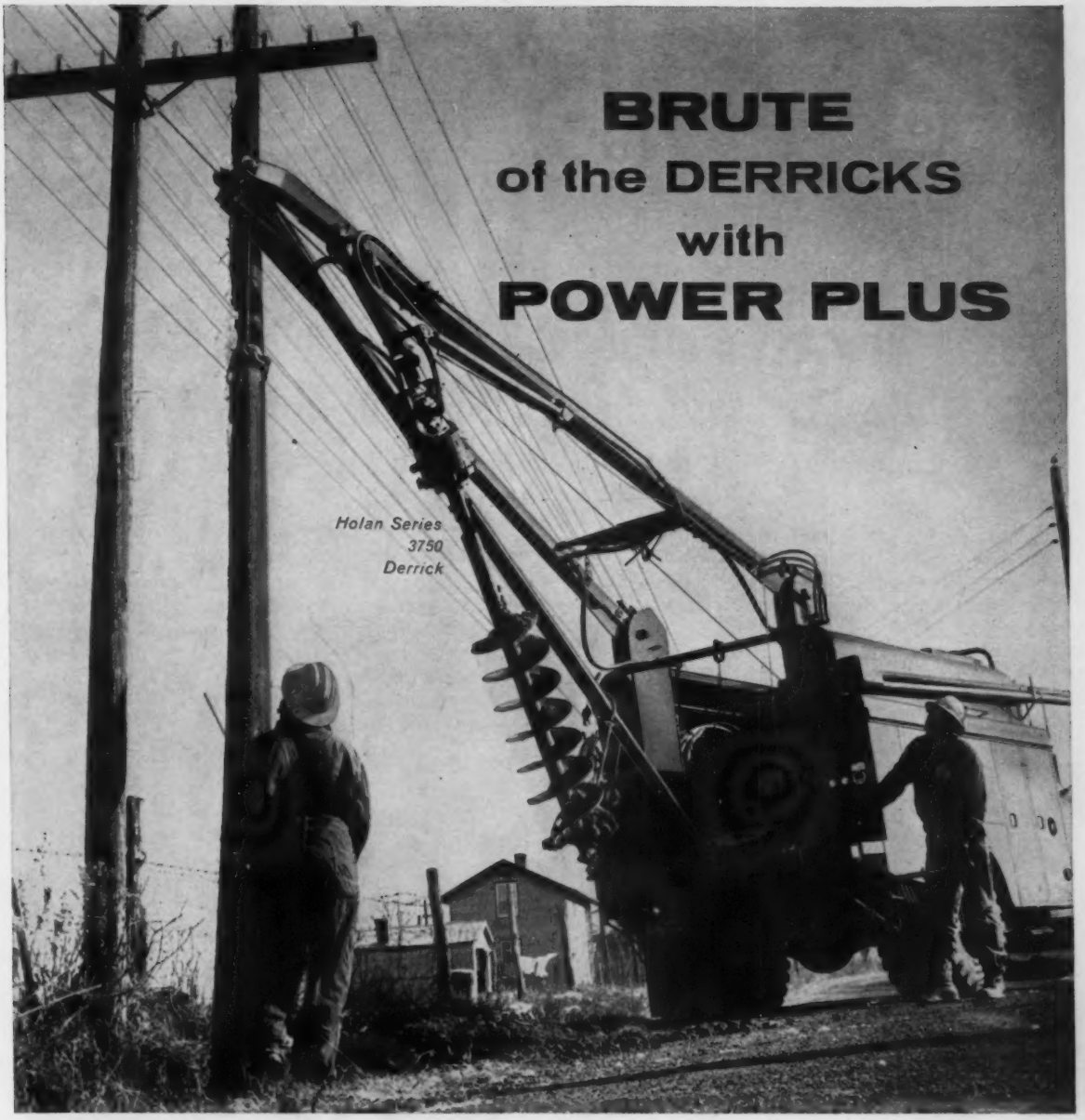
Export Sales—Philips Export Co., 100 East 42nd St. New York 17, N.Y.

Sold by Leading Electrical Distributors

PENN-UNION *a good connection*

Catalog Sheets or Samples on Request

For phone number of closest representative see advertising index in back of book.



It's been called "a brute of a derrick" by utility crews all over the country. That's because the new Holan Series 3750 Hydraulic Derrick with live boom is engineered to withstand abuse in the field.

And the 3750 has plenty of muscle. For the record, it has a 12,000-pound capacity, but it has actually been tested at 22,000 pounds.

An integral middle leg with live-boom action provides extra strength for butt-pulling, body loading and other heavy lifting assignments. The rectangular side legs are fabricated of long-lasting, rust-resisting high tensile steel.

Hoisting 5,000 pounds over the rear axle for body loading is a simple task for the 3750. And the 195° operating range makes it possible to lower the derrick to within five feet of the ground for easy threading of the winch line.

There's power to spare in the 3750—power for such tasks as forcing the Holan 5400 Multiple-Speed Digger shown here into hard and rocky soil. And the extra power makes it easy to remove an auger full of dirt.

Let us tell you more about this new Holan Derrick. Write us—or call your Holan Field Representative—for complete details.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

Holan
Subsidiary of THE OHIO BRASS COMPANY
HOLAN

For phone number of closest representative see advertising index in back of book.

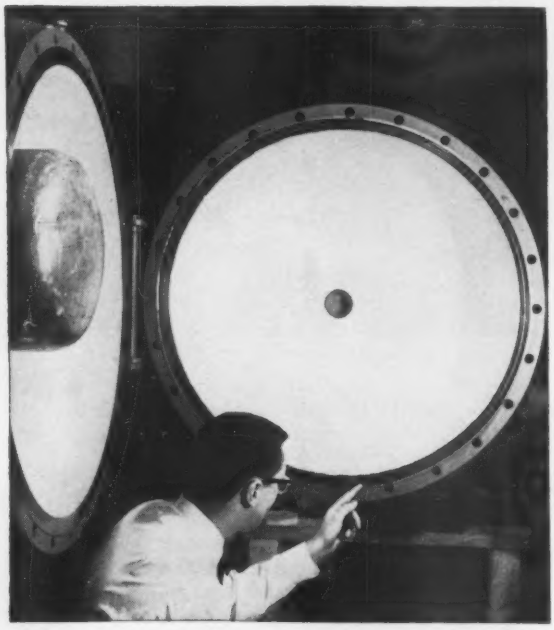
ONE OF A SERIES

New Level of Breaker Dependability Realized with Sealed SF_6 Gas System

...greatly improved performance from 69 to 450 kv and beyond

Unique properties of SF_6 (sulfur-hexafluoride) gas in a completely sealed pole unit enable Westinghouse power circuit breakers to deliver the full potentiality of the breaker. Full rated interrupting capacity is always ready to protect your system. Unlimited life of the interrupting medium, effectively sealed in, provides peak operating performance over periods of at least twice those of other breaker designs.

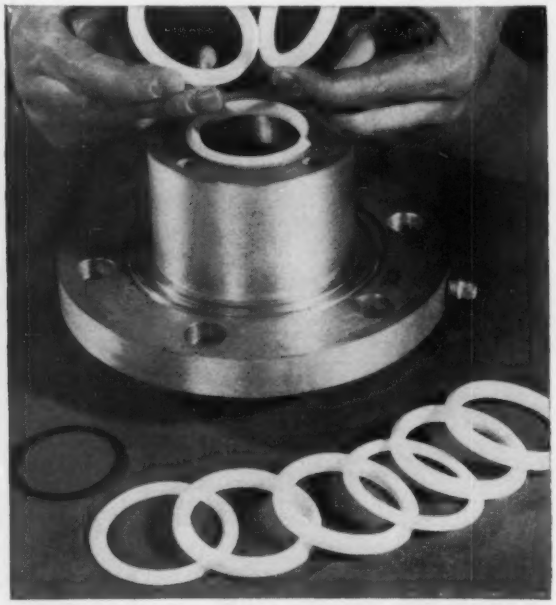
Static seals for the pole unit use a double "O" ring design. A neoprene material made especially for SF_6 application is used. Since a gas medium does not transmit surge shock, strain at seal locations is minimized.



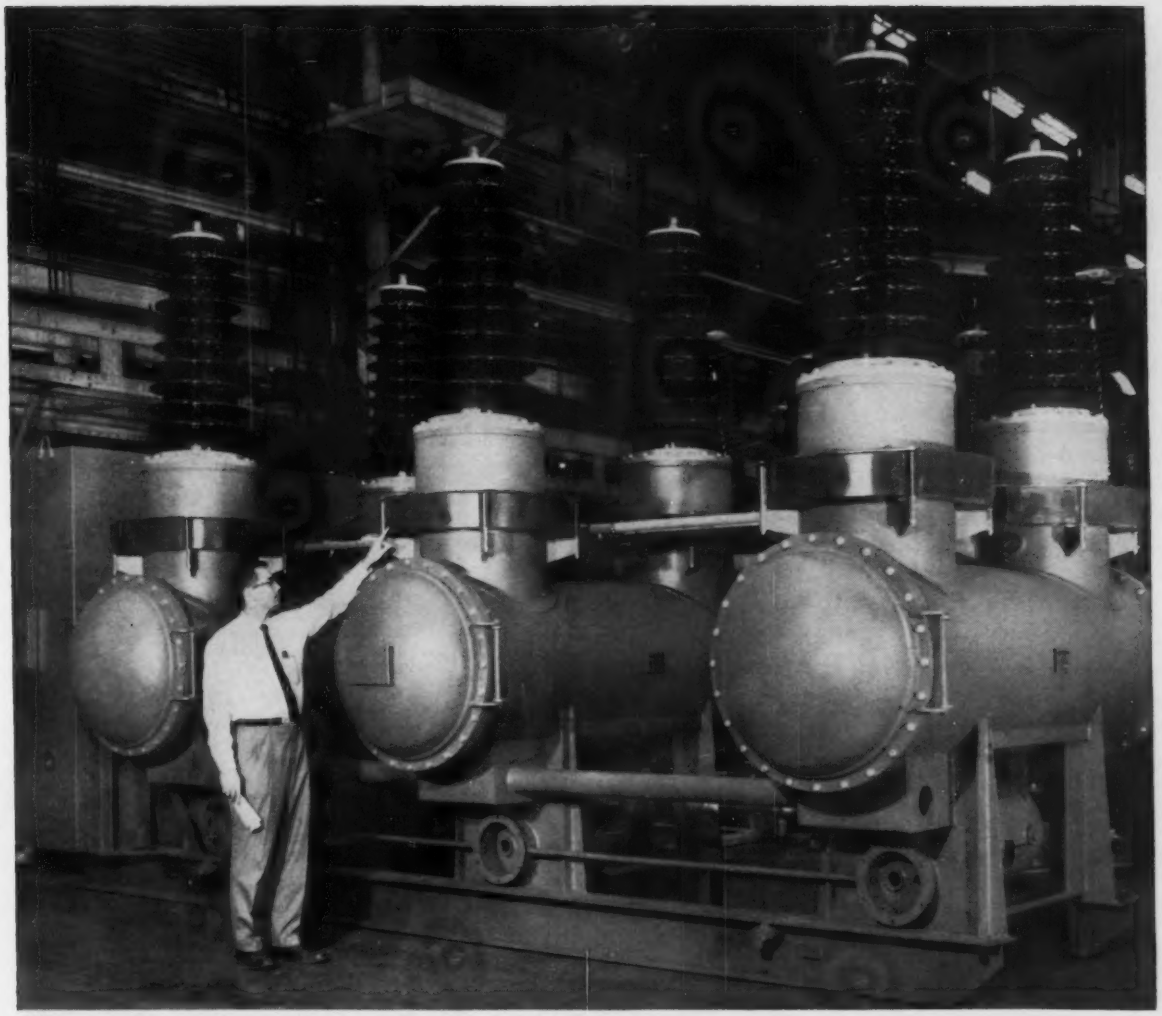
"Sniffer" holes at each double "O" ring seal are provided for detecting leakage.

Externally mounted current transformers eliminate the need for seals around the CT's.

Special care is devoted to the seal where the rotating breaker operating shaft enters the bottom of the pole tank. Here a series of teflon "V-Ring" seals are stacked and held in compression by a heavy-duty spring. Teflon, being nonporous, semipliable and having low static friction, is ideally suited for this application.



The SF_6 gas, itself, virtually has unlimited life as the interrupting medium. Repeated arc interruptions in oil, as shown on opposite page, produce rapid carbonization. Mass spectrographic analysis of SF_6 gas after duplicate tests shows that sulfur-hexafluoride suffers practically no decomposition. Life of the interrupting medium ceases to be a factor in determining maintenance schedules!

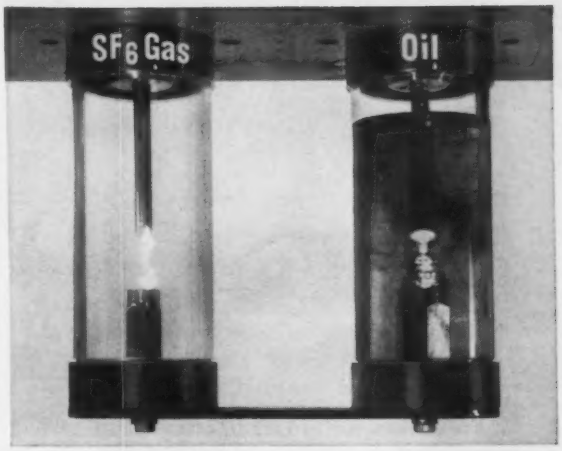


SF6 gas breakers are designed for a new level of dependability.

Activated alumina filters absorb the minute quantities of gaseous arc decomposition products which are produced.

In addition, dead tank construction, with all its inherent advantages, is used in the design to gain a new level of dependability. A standard, time-proven, pneumatic mechanism closes the contacts and at the same time stores the energy for opening by compression of the accelerating springs . . . a fail-safe device. All contacts of all poles are mechanically tied together to assure simultaneous operation and reliable relay indication. Current transformers on both sides of breaker provide for overlapping relay protection.

Learn more about lower installation and maintenance costs, quieter and safer operation, and increased breaker dependability . . . just give your Westinghouse sales engineer a call. Or, simply write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. You can be sure . . . if it's Westinghouse. J-61005



Westinghouse

For phone number of closest representative see advertising index in back of book.

All your kitchen appliances will be clean, cool electric appliances in a Medallion Home

An all-electric kitchen is just one of the advantages you'll find in a home bearing the Medallion Home award

Every Medallion Home guarantees you:

1. An all-electric kitchen, with major electric appliances such as a modern range and oven ... all part of the basic home plan and price.

2. Full Housepower wiring for present, and future needs to handle the appliances you own today *plus* those you'll want tomorrow.

3. Provisions for proper lighting in all areas where it's needed to insure your family's safety and comfort.

And, for the ultimate in luxury living, there's the **all-electric** home—the Gold Medallion Home with a modern electric heating system such as the amazing electric heat pump that both heats *and* cools.

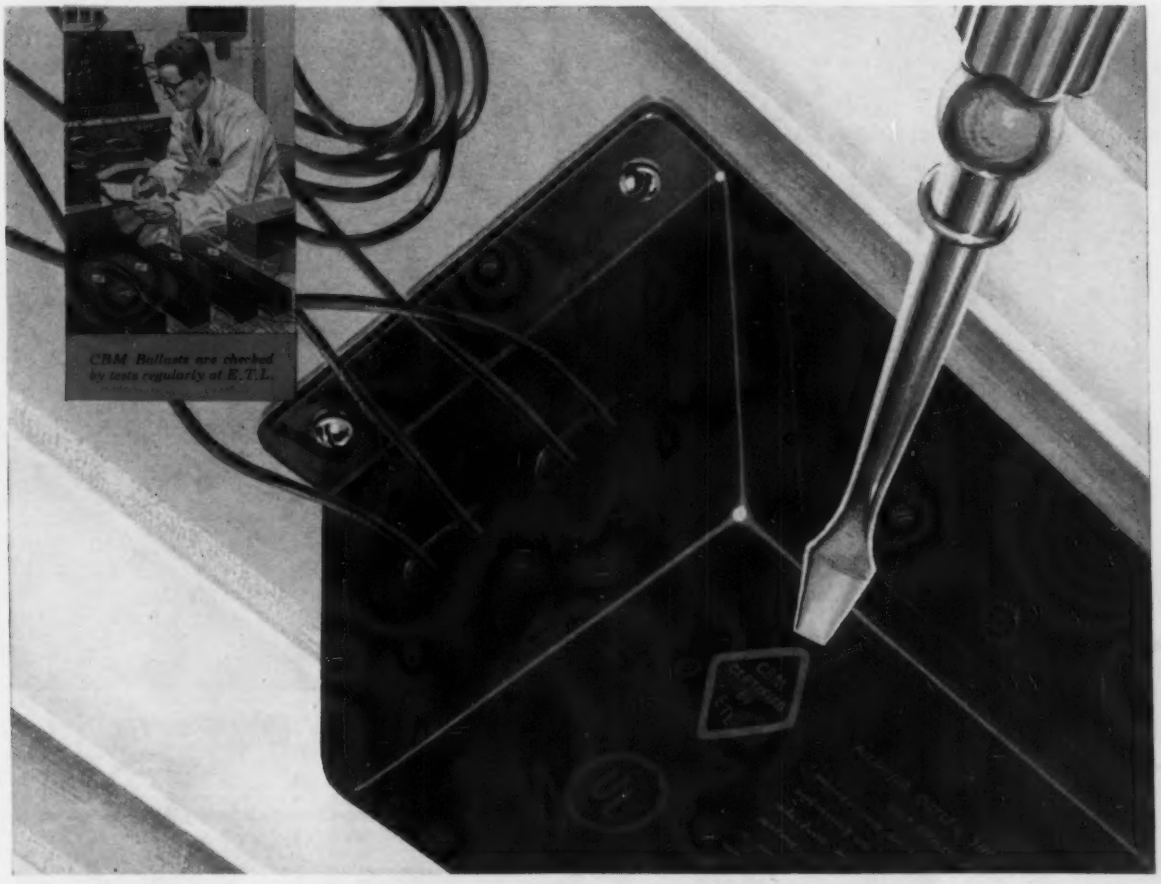
Always remember... look for the Medallion award before you buy *any* new home.

SOUTHERN CALIFORNIA Edison COMPANY *helps you* LIVE BETTER—ELECTRICALLY

THIS EMBLEM ON A FIXTURE BALLAST BRINGS YOU PRACTICAL ADVANTAGES

CBM CERTIFIED by ETL ©

Participation in CBM is open to any manufacturer who wishes to qualify 4-60



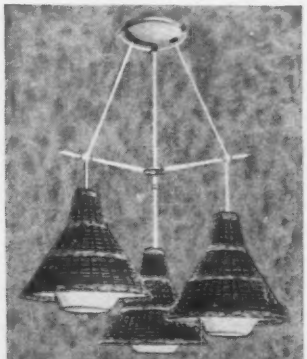
Among them . . . up to 40% more light output and sustained peak light output to give the benefits of today's recommended higher lighting levels. You also get long lamp and ballast life . . . positive starting . . . U. L. listing . . . **in short, performance that meets specified CBM standards** . . . checked and certified by Electrical Testing Laboratories. Enjoy CBM benefits on fixtures that you sell or specify. And to keep pace with CBM progress, ask us to start mailing you "CBM NEWS".

CERTIFIED BALLAST MANUFACTURERS ASSOCIATION, 211 Keith Building, Cleveland 15, Ohio.

the light idea®

SUN 'N SAND Unique, different . . . appealing! Shades are an arresting blend of imported Italian sand-tone reed, handwoven with glistening brass accents. Satin white, diffusers. Sun 'N Sand — original . . . beautiful . . . modern!

V-5675 For hallways or tasteful accent lighting. Length 8¼", diameter 6½". One 100-W.



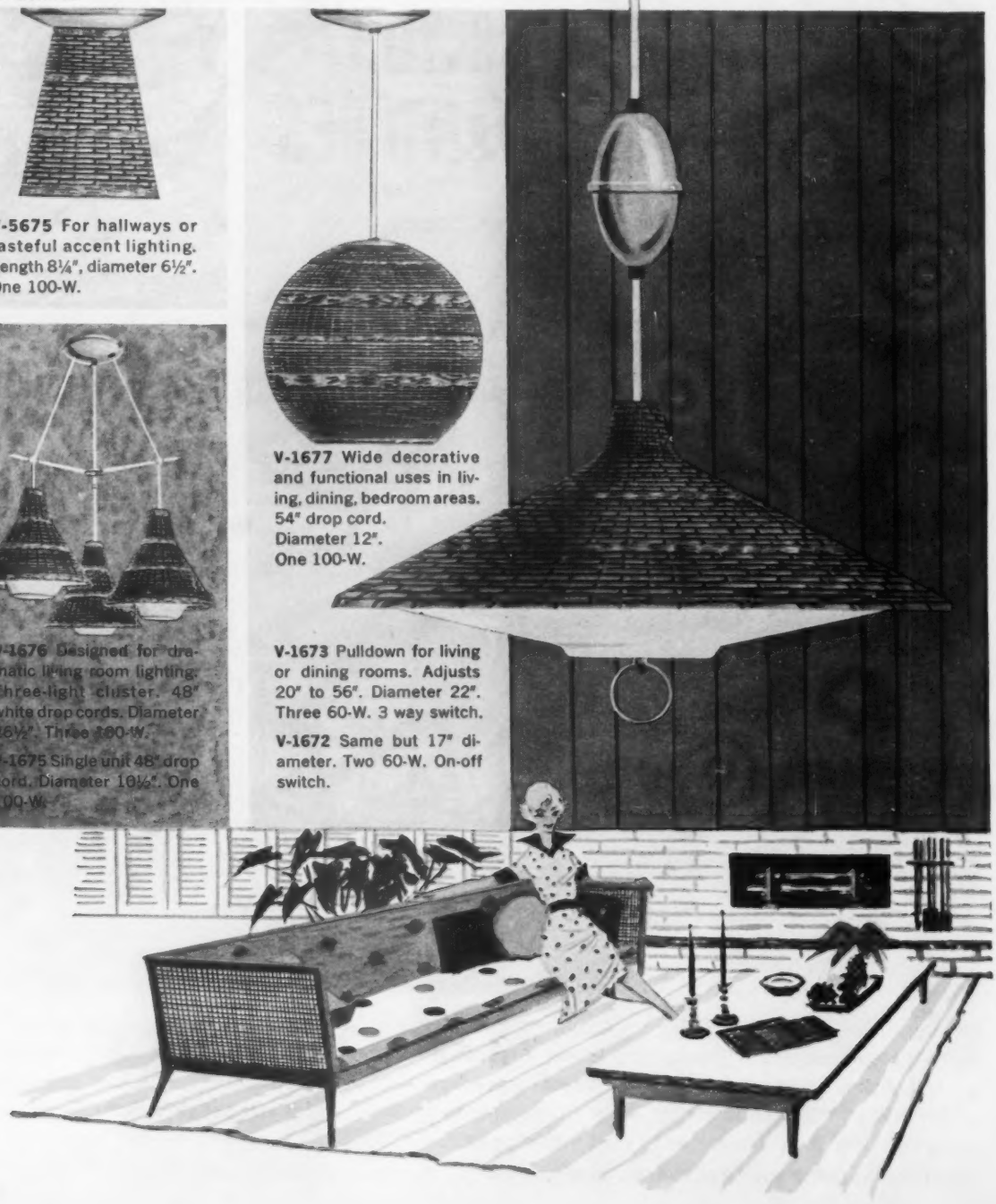
V-1676 Designed for dramatic living room lighting. Three-light cluster. 48" white drop cords. Diameter 26½". Three 100-W.

V-1675 Single unit 48" drop cord. Diameter 10½". One 100-W.

V-1677 Wide decorative and functional uses in living, dining, bedroom areas. 54" drop cord. Diameter 12". One 100-W.

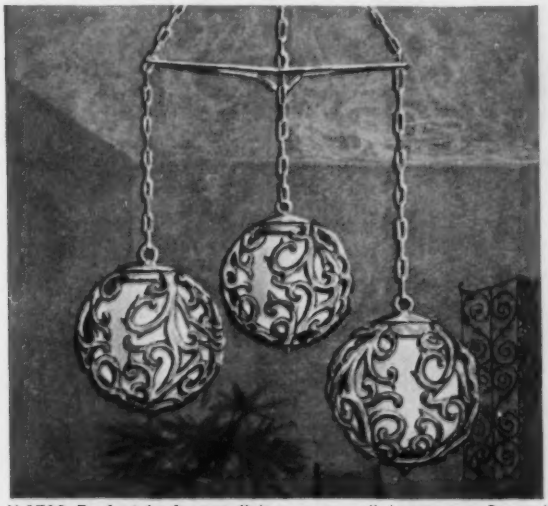
V-1673 Pulldown for living or dining rooms. Adjusts 20" to 56". Diameter 22". Three 60-W. 3 way switch.

V-1672 Same but 17" diameter. Two 60-W. On-off switch.



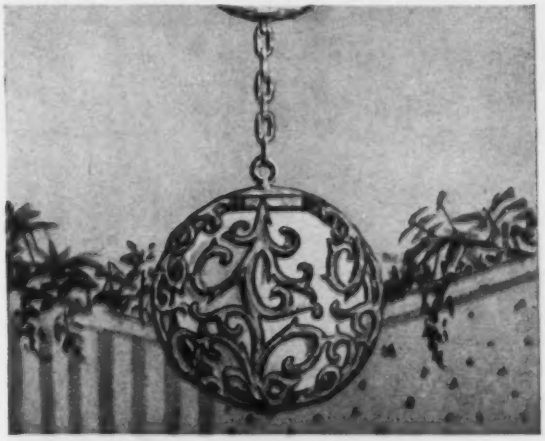
new custom creations

FLORENTINE SERIES Exquisitely detailed scrolls cast in aluminum. Antique white color delicately toned with gold fleck. White opal globes. Matching white chain. Here is new richness for all homes — contemporary, transitional, traditional!



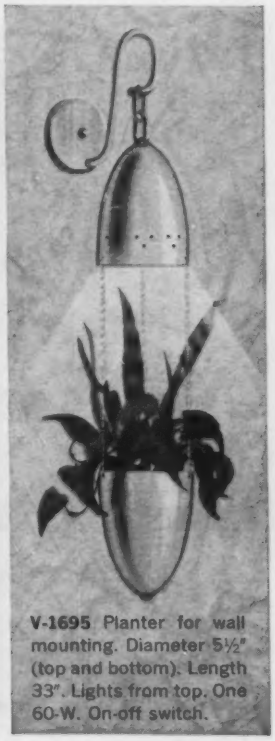
V-1713 Perfect in foyers, living rooms, dining areas. Spread 31" (6' chains and yolk). Three 100-W.

V-1712 Diameter 12". Matching white 6' drop chain. One 150-W.
V-1710 Same as above: Diameter 10". One 100-W.



PLANTER SERIES Bright ideas! Lighting fixtures that double as planters. Perfect accents for fireplace, entranceways, in dinettes or family rooms . . . wherever you want a touch of eye-catching beauty!

V-1690 Polished brass. Diameter 15½". Length 36". Lights from top. Three 60-W. 3 way switch.



V-1695 Planter for wall mounting. Diameter 5½" (top and bottom). Length 33". Lights from top. One 60-W. On-off switch.

These are just a few of the fresh, new custom creations available...fixtures so delightfully different and irresistibly styled..."to show is to sell." Free colored brochure describing the full line available. See your nearest Virden Lighting distributor or write direct using the coupon below.

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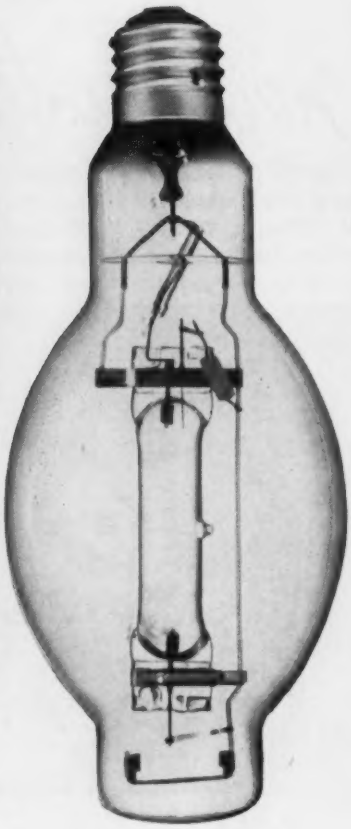
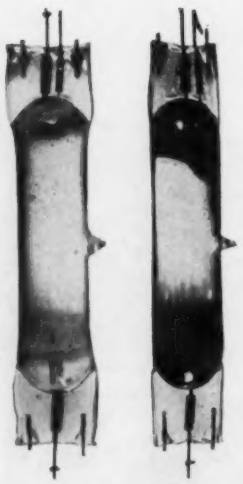


New G-E "Bonus Line" Mercury Lamps. 6000 extra hours! That's the bonus your customers get in every 400-watt G-E "Bonus Line" Mercury Lamp . . . and a minimum of 3,000 hours extra in the other wattages. One look at these two light-producing arc tubes and you can see why General Electric "Bonus Line" Mercury Lamps are their best bargain. See how the one from a G-E Lamp stays white? That's because its special electrode doesn't deposit a *black* coating, but a translucent *white* coating that lets the light come through. The result: your customers get as much light at *9,000* hours as ordinary mercury lamps give at *3,000* hours. General Electric "Bonus Line" lamps now available in *all* sizes from 100 to 1,000-watts . . . in all popular shapes and "colors" . . . *at new low prices.*

Men in the know . . . know they get important differences when they specify General Electric Lamps—whether they're mercury, filament or fluorescent. So let your General Electric Lamp distributor explain the important plus you can get in the lamp types you use. General Electric Company, Large Lamp Department, C-033, Nela Park, Cleveland 12, Ohio.



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ORDINARY ARC TUBE AFTER 8000 HRS.

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For phone number of closest representative see advertising index in back of book.

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Here, R. G. Smith, CADWELD Southeastern District Sales-manager, personally instructs a construction crew foreman in CADWELDING a grounding grid system for a southern electric utility.

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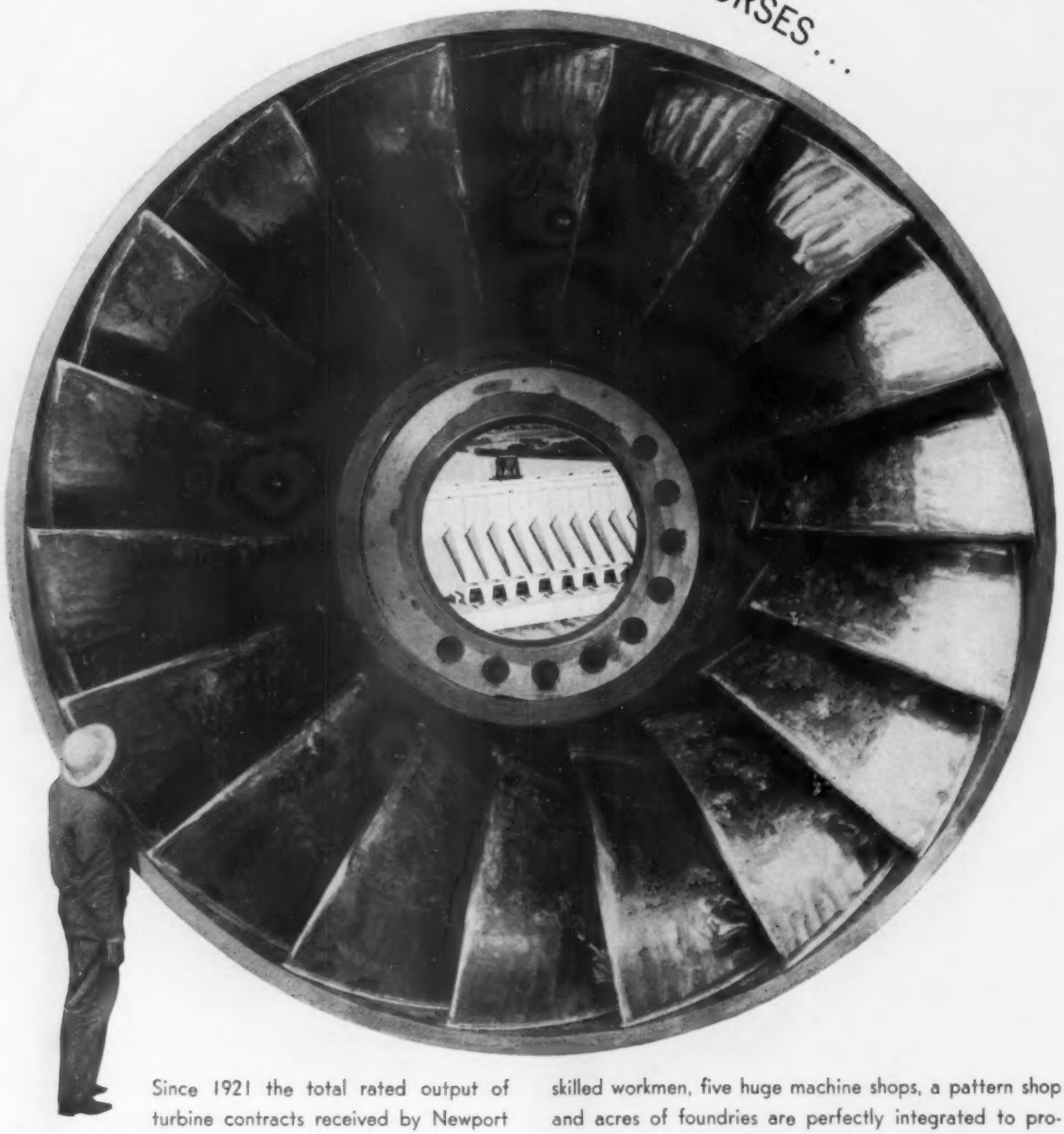

Since 1921 the total rated output of turbine contracts received by Newport News exceeds 12,000,000 horsepower. The Niagara Project, Grand Coulee, Hoover and Chief Joseph are but a few of the installations for which Newport News has designed and built such equipment as hydraulic turbines, valves, gates and penstocks.

Newport News has the men . . . the methods . . . and the machines to take gigantic jobs like these in stride. Large engineering and design staffs, hundreds of highly skilled workmen, five huge machine shops, a pattern shop and acres of foundries are perfectly integrated to produce large units in the shortest possible time . . . from water power equipment to wind tunnels, from cracking towers to paper dryer rolls.

Look to Newport News with its seventy-five years of metal fabricating experience. Your inquiries are invited.

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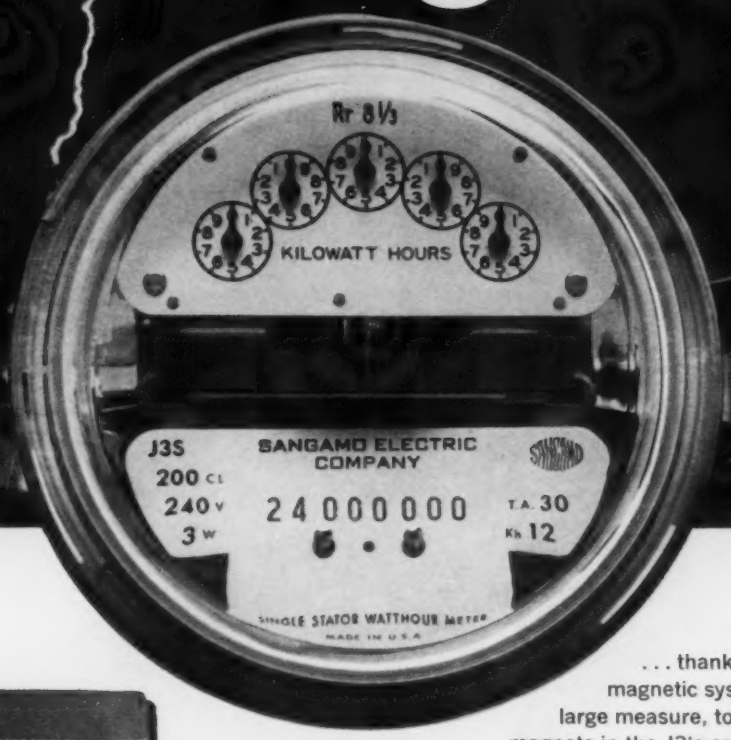
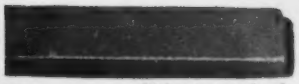
SHIPBUILDING AND DRY DOCK CO.
NEWPORT NEWS, VIRGINIA

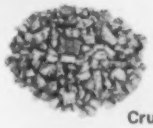
THE SANGAMO J3 SHRUGS OFF SURGES



. . . thanks to the permanence and stability of its magnetic system. Permanence and stability due, in large measure, to the high quality and uniformity of the magnets in the J3's controlled floating system.



Alnico as received



Crushed

Ground

Bonded Alnico Magnets

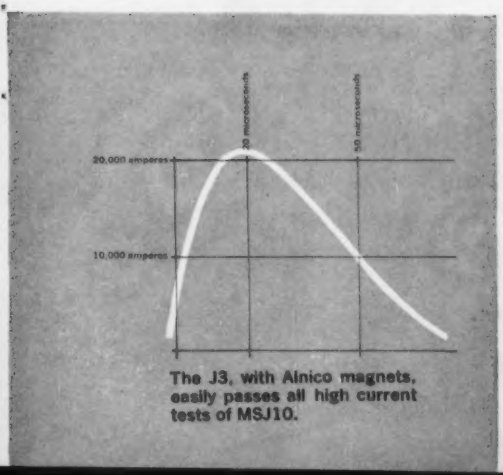
These magnets are made by Sangamo. Made of bonded Alnico. Extra-high coercive force Alnico material is crushed and ground into a fine powder, then bonded into magnets . . . dimensionally and magnetically uniform magnets that have none of the variable characteristics associated with cast and sintered magnets. Each magnet is also thoroughly factory-aged to make sure its strength will not diminish through long years of service.

Actually, all of the components of the J3 are virtually unaffected by high surge currents—even after repeated surges of 20,000 amperes through the neutral wire and 2,000 amperes through the current coils. This includes the electromagnets as well as the Alnico floating system and damping magnets. Surges and short circuits which can de-magnetize even the best chrome steel magnets can't affect the J3 Alnico magnets.

The true magnetic floating system of the J3 never requires maintenance or replacement and is guaranteed for the life of the meter. That's just one of many good reasons why the J3 is your best investment in watthour meters.

Other reasons? A visible, self-cleaning gap; substantially reduced side thrust; insignificant tilt error; advanced insulation level; smallest size; better visibility for inspection and testing; highest torque; slowest speed; lowest watts loss; sectionalized construction; corrosion-resistant finishes and materials; glaskyd base.

Your Sangamo Representative has the complete J3 story. Get it; you'll discover that the J3 has everything you want in a watthour meter. And that's a promise, for this is one of the really great ones.



The J3, with Alnico magnets, easily passes all high current tests of MSJ10.

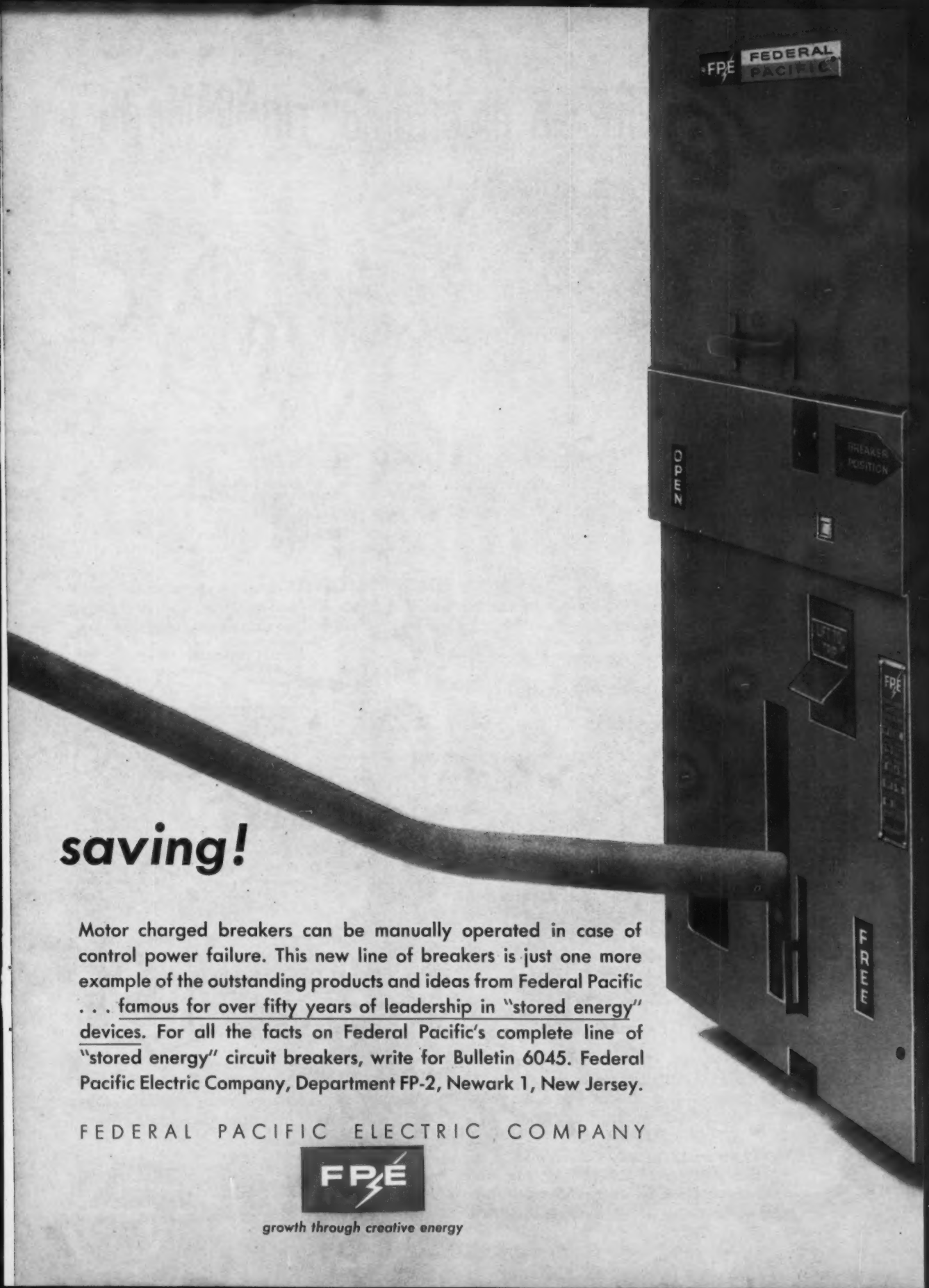
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

J3

the handle to a $5200

Just one stroke of the handle stores the closing energy in the new and unique Federal Pacific 5 KV and 15 KV circuit breakers. By eliminating outside power sources, the new breakers cut installation costs up to $5200 on battery, cable and control requirements alone. And "stored energy" is *safe* energy with Federal Pacific breakers . . . even for inexperienced operators! Our exclusive foolproof interlock prevents actuation unless instrument door is *closed and locked.* Also available . . . electric motor charged "stored energy" breakers . . . for new economy and reliability in unattended installations.



saving!

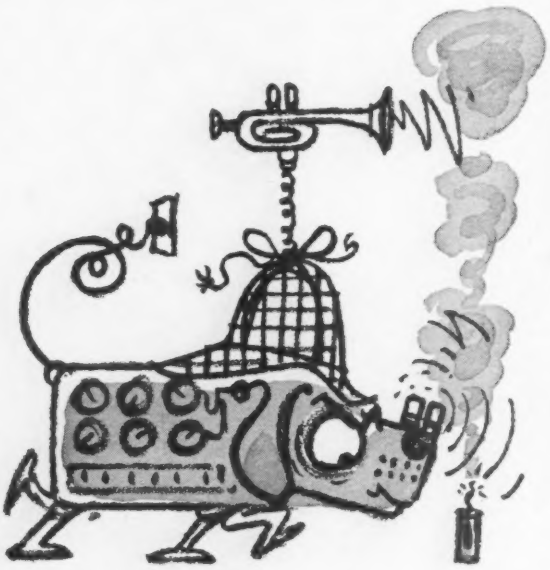
Motor charged breakers can be manually operated in case of control power failure. This new line of breakers is just one more example of the outstanding products and ideas from Federal Pacific . . . famous for over fifty years of leadership in "stored energy" devices. For all the facts on Federal Pacific's complete line of "stored energy" circuit breakers, write for Bulletin 6045. Federal Pacific Electric Company, Department FP-2, Newark 1, New Jersey.

FEDERAL PACIFIC ELECTRIC COMPANY

FPE

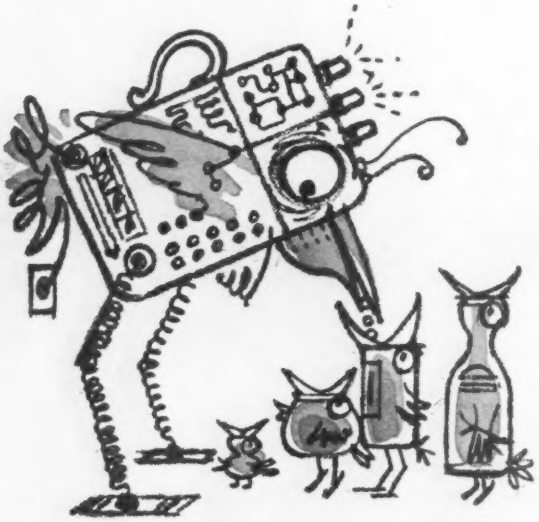
growth through creative energy

modernize with an electronic "THINGAMAJIG"!



PHOTOELECTRIC SNIFFERS smell out smoke—then summon the fire brigade, turn off ventilation systems, turn on sprinklers, shut down equipment, even close doors.

ULTRASONIC SCRUBBERS clean tiny component parts fast. This beats slow and costly old-fashioned ways, solves problem for precision equipment makers.



AUTOMATIC FILLER-UPPERS fill all types of containers accurately and quickly—even measure and mix liquids. Perfect for beverages, chemicals, drugs, foods...

ELECTRONIC COUNTERS count anything — hippos to hula hoops... tackle practically any counting problem with ease. Lots of industries are adopting them.

There are thousands of electronic devices that make work easier, safer and more productive. Call us for information on "thingamajigs" that apply in your field.

P·G and E·
Pacific Gas and Electric Company

Meetings Calendar

SEPTEMBER

7-9—*Northwest Electric Light & Power Assn.*, 55rd annual meeting, Glacier Park Lodge, Mont.

7-10—*Rocky Mountain Electrical League*, annual meeting, Denver Hilton, Denver, Colo.

12-14—*International Association of Electrical Inspectors*, Northwestern Section, Sheraton-Portland Hotel, Portland.

14-15—*Northwest Public Power Assn.*, Accounting Section, annual meeting, Wenatchee, Wash.

18-24—*IAEI*, Southwestern Section, Mapes Hotel, Reno.

29—*San Diego Bureau of Home Appliances*, annual fall conference, Balboa Park, San Diego, Calif.

29-30—*NWPPA*, Power Use Section, annual meeting, Hotel Monticello, Longview, Wash.

OCTOBER

18-21—*National Association of Electrical Distributors*, Western Region convention, Stardust Hotel, Las Vegas.

23-27—*National Electrical Contractors Assn.*, national convention and exposition, Las Vegas.

NOVEMBER

3-4—*American Home Laundry Manufacturers Assn.*, 14th National Home Laundry Conference, Fairmont Hotel, San Francisco.

25-Dec. 3—*San Diego Bureau of Home Appliances*, annual Electric and Home Appliance Show, Electric Building, Balboa Park, San Diego, Calif.

DECEMBER

1-2—*Pacific Coast Electrical Assn.*, Administrative Services Section, Hotel Safari, Scottsdale, Ariz.

12-15—*Atomic Industries Exhibition*, Masonic Auditorium, AIF—Fairmont Hotel, ANS—Mark Hopkins Hotel, San Francisco.

JANUARY 1961

16-20—*San Francisco Winter Market*, Merchandise Mart.

APRIL

5-9—*Electrical Maintenance Engineers Assn.*, Electrical Industry Show, Brooks Hall, San Francisco.

6-7—*Pacific Coast Electrical Assn.*, Engineering & Operating Section, Ambassador Hotel, Los Angeles.

17-18—*PCEA*, Business Development Section, Sheraton-Palace Hotel, San Francisco.

26-28—*Northwest Electric Light & Power Assn.*, Engineering & Operation Section, Personnel & Safety Section, Purchasing & Stores Committee, Sheraton-Portland Hotel, Portland.

27-28—*PCEA*, Administrative Services Section, spring conference, Villa Hotel, San Mateo, Calif.

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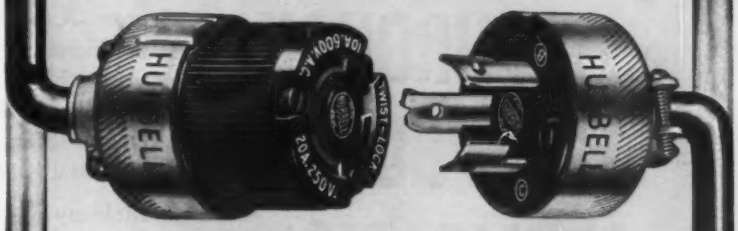
MAKES *SUPER*

Twist-Lock®

WIRING DEVICES



CAT. NO. **3323**
SUPER TWIST-LOCK
ARMORED BODY
20 AMPERES, 250 VOLTS, AC OR DC
10 AMPERES, 600 VOLTS, AC ONLY

CAT. NO. **3321**
SUPER TWIST-LOCK
ARMORED CAP
20 AMPERES, 250 VOLTS, AC OR DC
10 AMPERES, 600 VOLTS, AC ONLY

Super Twist-Lock devices are smaller, more compact and lighter in weight than regular Twist-Lock units. On the surface they look very much like their conventional brothers but actually they incorporate important construction features that place them in a class by themselves. Both the cap and connector body feature screwless pressure grip terminals which simplify and speed wiring and a revolutionary 2-piece dead front construction that seals out dust, dirt, lint, metal chips, etc. Terminals are pressure locked between the two independent sections so that all wiring is completely enclosed . . . the ultimate in wiring safety and security.

All units in the Super Twist-Lock line can be interchanged with regular Twist-Lock connectors of equal rating. This is most advantageous in industrial plants where regular Twist-Lock devices are now installed on machine tools or other equipment.

For complete information on Hubbell Twist-Lock devices, see Hubbell Catalog #29 or check Sweet's File 31b/Hu.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

HARVEY
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POWER TRANSFORMER SOUND REDUCTION THROUGH PROPER APPLICATION OF A SPECIAL NEW CORE STEEL

Improved power transformer cores having a marked reduction in the sound energy generated are now available as a result of a basic development program directed at the source of sound as contrasted to the suppression of sound

by

C. M. LOVELL,

Vice-President in Charge of Engineering and Research

Introduction

Many important steps have been taken by the transformer manufacturers in recent years to reduce power transformer sound; but in some areas, the electric utilities' transformer sound problem has continued to grow. A big factor in the growth of this problem is the increased public sensitivity to transformer sound. While this may be absurdly acute in some cases, the fact of a growing and serious public reaction makes the problem of sound of major concern to the electric utilities.

Moloney Electric Company is conducting several developmental programs to obtain practical and economical methods of alleviating the utilities' transformer sound problem. The particular program discussed here is a basic development program aimed at reducing sound levels by attacking the problem at its source through the proper application of a new core steel.

SOURCE OF SOUND

Sound energy is generated in the power transformer core by magnetostriction—a pulsating change in length of the core steel when carrying alternating flux. While some additional sound energy is generated by pulsating attraction forces within the core, this sound can be readily minimized by skillful core design and manufacture.

The sound energy thus generated by magnetostriction in the core is transmitted mechanically to the tank and outer accessories of the transformer—from there to the surrounding area.

APPROACH TO SOUND REDUCTION

There are obviously two main channels of attack on sound—

MOLONEY ELECTRIC COMPANY

Since 1896 . . . MORE POWER TO YOU . . . WITH

(a) Reduction of the amount of sound energy emanated from the transformer by using suppressive means.

(b) Reduction of the amount of sound energy generated at the source—that is, in the core.

A great deal of work has been done by the transformer manufacturers in the development of various means of suppressing sound. In those cases, however, where substantial and consistent reductions are achieved—such as with double tanks—the degree of cost increase is high. Also, the weight, dimensions, and complexity of the transformer are substantially increased. With lesser suppressive means—such as resilient supporting pads—the sound reductions achieved tend to be marginal and inconsistent.

These results indicate that reduction of the sound energy generated at the source is a more positive approach to the problem than the use of suppressive means.

NEW SPECIAL TYPE OF STEEL

In response to a request by the Moloney Electric Company, the Allegheny Ludlum Steel Corporation has developed and made available a special low magnetostriction steel known as "SILECTCOR".

This special steel is stress free, exceptionally flat, and has a remarkably low magnetostriction characteristic. Basic watt loss or permeability remain the same as for conventional cold-rolled oriented steel.

APPLICATION OF THE SPECIAL NEW STEEL

To properly apply SILECTCOR to power transformers on a production line basis it was necessary that new core design and manufacturing techniques be developed. Without these new techniques, the superior qualities of the special steel would not be reflected in improved core performance.

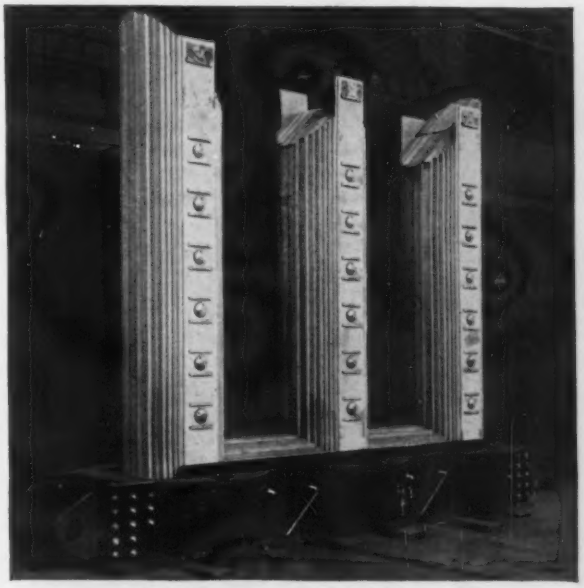
The new core design and manufacturing techniques necessary were developed by Moloney Electric Company after an extended research program to determine the design and production procedures that would result in the lowest sound levels at a reasonable cost.

To date, these new techniques and the special steel have been successfully applied by Moloney Electric Company to approximately 150 power transformers ranging in capacity from 500 KVA to 217,000 KVA. It is planned to steadily increase the application of this new steel to Moloney power transformer production.

RESULTS ACHIEVED

Other factors the same, average reductions of approximately 8 decibels in sound level are consistently attainable as a direct result of the proper application of SILECTCOR to the larger sizes of power transformers. The reductions decrease gradually to approximately 4 decibels for the smaller sizes.

It is significant that these sound level reductions are attainable for a reasonable manufacturing cost increase and without increasing weight, dimensions, or complexity of the transformer.



Cores built with SILECTCOR are remarkably straight as illustrated. This straightness minimizes clamping stress concentration and thus leads to side benefits of reduced core loss and exciting current.

The program is a good example of the positive value to the electric utilities of the constructive research and development being carried on in the manufacturing industry. Moloney Electric Company is conducting continuous research and development programs both in cooperation with customers and suppliers, and independently, to find better answers to the transformation problems facing the industry. ME-60-22

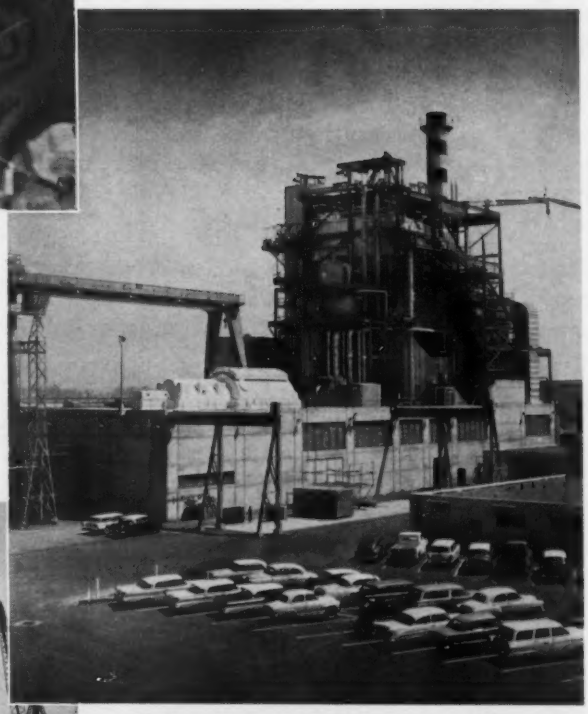
FACTORIES: ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

TRANSFORMERS FOR UTILITIES • INDUSTRY • ELECTRONIC APPLICATIONS

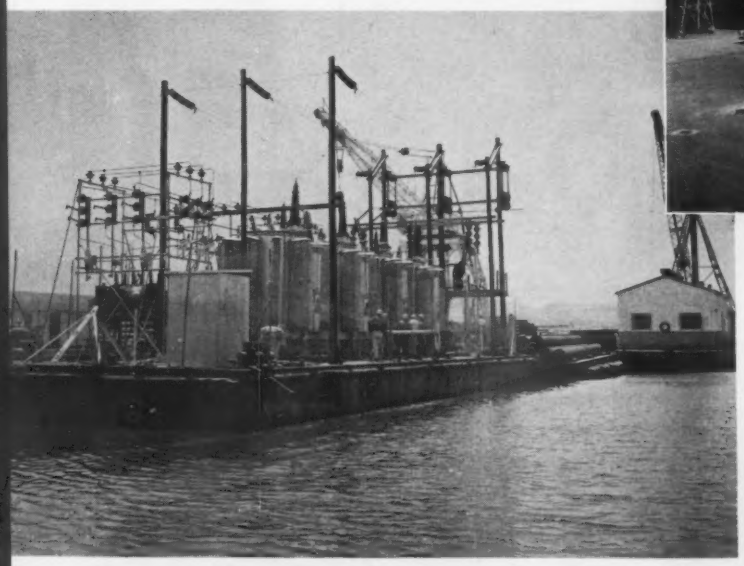
For phone number of closest representative see advertising index in back of book.

news

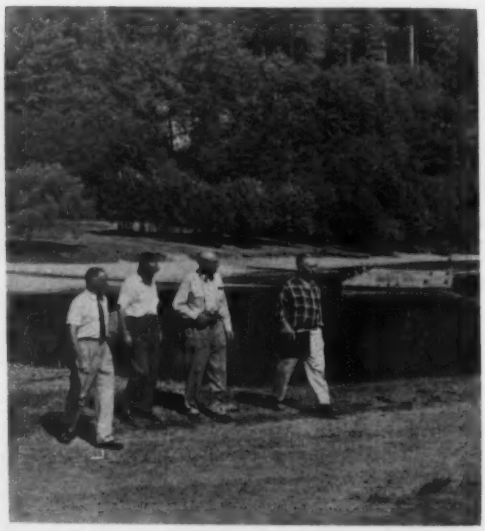
Representing the 300,000 homemakers in San Diego Gas & Electric's service area, to whom South Bay power plant's unit one is dedicated, Mrs. Orval Searcy helps President E. D. Sherwin bolt the inscription to the generator. Mrs. Searcy, San Diego's Woman of the Year, later was given a bouquet of 142 red roses, representing the additional 142,000 kw of electricity being produced at the plant. Reddy Kilowatt figures, lined up on the stage, bore standards, reading Reddy for Business and Industry; Reddy for Homes; Reddy for Agriculture and Street Lighting. Some 125 dignitaries attended the ceremony



Dedicating the $22,500,000 South Bay plant at San Diego, President Sherwin said that a second 142,000-kw unit is already under way and scheduled for operation in 1962. The new unit will cost $18,500,000



A floating substation was built by Pacific Gas and Electric Co. to serve dredging operations of Utah Construction & Mining Co. in Redwood City Harbor. The 2,400-ton Franciscan, one of the world's largest dredges, will be connected to the floating sub by a 12,000-v armored submarine cable that can be reeled out as the dredge moves along the channel. The operation will widen and deepen a three-mile area



Touring recreational facilities at Pacific Power & Light Co.'s Lewis River hydro plants in Washington was Thomas J. Rouner, left, vice-president of New England Electric Co., Boston, and a member of the National Outdoor Recreation Resources Review Commission. With him are E. Robert de Luccia, vice-president and chief engineer, Leo Miller, engineering designer, and John Beach, Lewis River land supervisor, all of PP&L

EW

Contract Signed on Sultan River Project

A contract signed by commissioners of the Snohomish County PUD and Everett city officials paves the way for a $45 million development of the Sultan River to provide power for the PUD and water for the city.

Present plans call for development of the river in two steps. The first, on which work is expected to start next year, calls for construction of the first stage of a concrete-arch dam in the Sultan River gorge. The initial step will provide 20,000 acre-ft of usable storage.

Start of construction on the second step is not expected before 1967, when the 140-ft dam will be raised another 100 ft. Other facilities include a 190-ft-high earthfill dam downstream from the main storage dam, increasing the height of the city's existing diversion dam and three power houses with associated tunnels, penstocks, transmission lines and other facilities.

Ultimate development will provide more than 100,000 acre-ft of usable storage and the three power houses will contain a total installed generating capacity of 140,000 kw.

The contract provides that water supply shall have precedence over all the other uses of Sultan River water. The city will pay one-half of all the costs of the total project that will be useful for water supply purposes, including raising the main storage dam to its ultimate height. The PUD will supervise construction.

Western Colorado Project In Design Stage

Proposal for a multimillion-dollar private hydroelectric development project in western Colorado has been outlined by Rocky Mountain Power Co. and its engineering consultant, Van Sickle Associates Inc.

M. J. Greer, chief engineer for Van Sickle, said the project is "at the design stage and an optimistic estimate is that it will be completed in three to five years."

Rocky Mountain Power, headed by Paul G. Van Sickle, proposes a $27 million development that would be privately financed, Greer said. Two hydroelectric power plants with a combined capacity of 56,000 kw would be constructed northeast of Glenwood Springs, utilizing water from tributaries of the South Fork of the White River and tributaries of the Colorado River. Greer said the power would be generated by two plants utilizing 2,700 ft of head water.

Japanese Company Gets First Contract From Interior

In its first choice of a Japanese company to supply generating equipment for federal power projects, the Interior Department gave Hitachi New York Ltd. a $664,860 contract for two turbines for Trinity power plant in California.

English Electric Export & Trading Co. Ltd. of New York was also given a contract for two turbines for the same plant. This contract totaled $832,830.

In both cases, the difference in bids by the foreign companies and those by U. S. firms was greater than the 6% differential required by the Buy American Act.

The two foreign concerns offered lower bids than U. S. companies on two other turbine contracts, but a department rule specifies that a company which had not previously made turbines for federal reclamation projects should be allowed only one major turbine contract for the first time.

NEWS INDEX

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Electric League Expands At Los Angeles

The Los Angeles Electric League will change its name to the Electric League of Southern California Inc., and will extend its scope to cover the Los Angeles marketing area under the terms of an amended constitution filed for the league's board and members by Robert Leonard Jr., president of Leonards International, and of the Electric League of Los Angeles.

Kennedy

Southern California Edison Co. has announced its intention of becoming a member of the expanded league whose membership will now be open to all electric utilities and other related interests in the area.

Appointed to head the expanded program is Mel G. Kennedy, who was made executive director. Active for a number of years in the sales marketing and public relations field, Kennedy has most recently been with Ebasco Services as manager of the sales, marketing and public relations department.

He started in the electrical field with Pacific Power & Light Co., where he served as sales promotion supervisor and assistant general sales manager. He has also been with Kansas Power & Light Co. and Pennsylvania Power & Light Co. in advertising positions. He attended Washington State College and the Walla Walla School of Business.

► A contract for $52.6 million for **construction of the sprawling South Fork project** has been awarded formally by the Oroville-Wyandotte Irrigation District to a five-company combine headed by Guy F. Atkinson Co., South San Francisco, Calif. The formal award followed by minutes the receipt and acknowledgment of a successful bid on $62 million in district bonds. A syndicate submitted a bid of $65.16 million for the OWID bonds. Financial consultants for the district computed the interest rate at 4.17% and declared it favorable.

Plant Additions Seen for Northwest

Bonneville Power Administration has made tentative allocations for sale of 375 mw of combined firm and secondary power for two new electroprocess industries in the Pacific Northwest and plant additions for two existing industries. Investment in the new plant facilities is expected to total $140 million.

Administrator William A. Pearl said four successful applicants for the block of power offered last May to industries, and their plans, are as follows:

Webb & Knapp Inc., construction of a steel mill at Anaconda, Mont., to reclaim copper and zinc and produce about 350,000 tons of steel annually from slag, allotted 44,000 average kw of firm and 52,000 average kw of secondary power with an initial service July 1962.

United Pacific Aluminum Corp., construction of two aluminum potlines at a site near Longview and possibility of some processing locally, allotted 45,000 kw of firm and 75,000 kw of secondary with initial service not later than January 1962.

Harvey Aluminum Inc., construction of two additional potlines at a location not yet determined, allotted 75,000 kw of firm and 80,000 kw secondary power, with initial service not later than December 1963.

Crown Zellerbach Corp., modification of pulp processing at the Port Townsend, Wash., plant, allotted 2,000 kw of firm and 2,000 kw of secondary, initial service date to be announced later.

"Successful completion of contract negotiations based on letters of intent from each company will be dependent in part on supplemental appropriations to permit BPA to construct major grid additions to serve the two new industries," Pearl said. "Financing arrangements by the companies and firming up of BPA service plans are expected to be resolved in the near future."

Successful completion of the contracts would increase BPA's annual revenues by about $6,500,000.

Tacoma Lowers Wholesale Power Requirements

Tacoma City Light will lower its requirements for institutions seeking to purchase power wholesale, under a change approved by the Public Utility Board. The change lowers the acceptable minimum kilowatt capacity of qualifying institutions from 500 to 200.

J. D. Ferguson, City Light superintendent, said the change is designed to make electrical heating more attractive for use in elementary schools, which usually use less than 500 kw. The rate requires the user to install its own transformer and cable.

Group Approves Tie-Line

The Washington State Power Advisory Committee has recommended to Gov. Albert D. Rosellini that the state's surplus hydro power be sold to California for a 10- to 20-year period. The committee is headed by Shirley Marsh of the Cowlitz PUD.

The group urged action on construction of a high capacity transmission tie-line if it is found to be economically feasible and provided that there are proper safeguards against export of power needed in the Northwest.

The committee also recommended that no contract for the sale of federal power outside the Pacific Northwest be executed "until such safeguards are developed to protect utility and industry rights to federal power in the Pacific Northwest." It favors construction of a steam-electric generating plant at Cle Elum as a move that "could effectively support hydroelectric power and energy transmitted to California."

Preliminary planning for such a plan has been carried out by H. Zinder & Associates of Seattle, which has been retained by California to report on feasibility of a connection between Pacific Northwest and California power systems.

► **Federal Pacific Electric Co.** was low of nine bidders with $90,450 when the Portland Army Engineer District opened bids for the design, manufacture, test and delivery to Oakridge, Ore., of one 27,000 to 36,000-kva three-phase power transformer and appurtenances for the $46.1 million Hills Creek project on the Middle Fork Willamette River. The flood control and power project will have installed generating capacity of 30,000 kw.

► **Sacramento Municipal Utility District** troubleshooters found a brand new cause for a transformer short. A fisherman, practicing casting in his back yard, got his plug snagged on a power line. In attempting to free his line, he pulled the parallel lines together and the short occurred to blow out the transformer.

Record Construction Budget Adopted at Los Angeles

The Los Angeles Board of Water & Power Commissioners has adopted a record $235,645,000 budget for the fiscal year that began July 1. The figure is almost $27 million more than last year's budget.

Almost $78 million will be allocated to the department's construction program, a $20 million increase over the building activity of the past fiscal year.

Revenue from electricity sales is expected to be $122,571,000, a gain of more than $10 million over 1959-60. Water sales will reach $39,485,000, almost $3 million more than last year. Funds available from bond issues and other sources will bring in total receipts of $169,654,000 for the power system and $65,991,000 for the water division.

► **Registered taxpayers voted approval,** 4,212 to 325, to extend for another 25 years Southern Colorado Power Co.'s operating franchise in Pueblo. The franchise voted 25 years ago was approved by a 2-to-1 margin compared with the latest 13-to-1 margin. The company has an investment of more than $35 million in its generating and distribution system in Pueblo, Otero, Crowley, Teller, Custer and Fremont Counties. It paid a franchise fee of $65,000 last year to the Pueblo city government and estimates that payments under the new franchise will run about $100,000 annually. During the next 25 years, it will spend an estimated $50 million in Pueblo County for system expansion and improvements.

Pleas Changed

Two manufacturers—I-T-E Circuit Breaker Co. and Federal Pacific Electric Co.—changed their pleas in the federal antitrust case involving alleged price fixing. Pleas of guilty were entered at a rearraignment in U. S. district court at Philadelphia.

W. M. Scott, I-T-E president, said that the substitute indictment returned by a federal grand jury covered a much shorter span of time of alleged violation compared with the original indictment in the power switchgear case returned in mid-February.

"Further study since that time convinced the company that the probability of establishing complete innocence or achieving other favorable outcome with respect to the switchgear case was remote," Scott said.

Cost Comparable to Cast in Place

The largest precast concrete vault ever constructed in the Bay area, and possibly in the world, has been successfully installed on Jackson Street in Oakland, Calif. Weighing 75 tons and measuring 8x30x8 ft, the king-size compartment will become a Pacific Gas and Electric Co. underground substation supplying electricity to approximately 350 nearby apartments.

When equipped, the unit will contain three transformers that will step 12,000 kv down to 220 and 110 v. Switchgear to distribute the power will also be housed in the vault.

Conceived jointly by Harold T. Welling, district gas superintendent for PG and E's East Bay Division, and the fabricator, Forni Division of Christy Concrete Products Inc., the huge structure was designed, poured and placed in 25 days. According to Welling, public convenience considerations led to the decision to precast the box at the Forni plant in Emeryville and truck it to the job site. Residents of the area were spared from form-building noises and the street was blocked a minimum of time, installation being accomplished by two of the largest cranes on the West Coast in less than a day.

Cost studies confirmed the feasibility of precasting the vault instead of casting it in place and this method permitted complete inspection inside and out. Among the plant tests conducted was one for leakage, performed by filling the box with 10,800 gal of water.

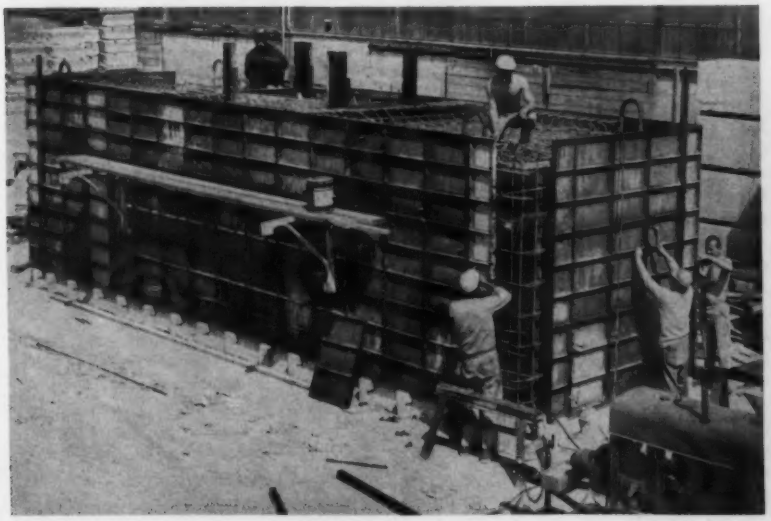
Precast concrete vault lifted into place at Pacific Gas and Electric substation

In construction, conduit ducts were provided in the 8-in.-thick walls and access holes were left in the 12-in.-thick roof. One-half, three-fourths and 1 in. diameter reinforcing bars were used and the roof was additionally reinforced with 8-in. heavy flanged I-beams weighing 31 lb to the foot. Picking provisions engineered into the Forni design included four 2-in. steel bar picking eyes with extra reinforcing bars embedded around them.

With increasing emphasis on underground utilities and with the ever-present public convenience and economic considerations, the dramatic Oakland installation may well be the forerunner of a prefabrication era in utility box construction. The precasting method should prove especially advantageous in installations where troublesome earth and groundwater conditions exist.

► **Klickitat County PUD** (Wash.) has selected a site in tht Trout Lake valley as the location for the major water storage dam in its plan for development of the power potential of the White Salmon River.

The vault was constructed in the shop, then trucked to the site fully assembled. Watching the operation are Jim Forni and John Christiansen of Christy Concrete Products, Harold T. Welling and Charles Ernshaw of Pacific Gas and Electric Co.



Standards Approved

Under a standardization program activated late in 1958, Seattle City Light has approved 112 standard specifications covering the purchase of 928 material items, according to H. V. Strandberg, chief engineer, chairman of the standards steering committee.

A total of 485 material items has been declared obsolete or put in a depletable category. Eleven City Light standards have been approved for all city departments.

City Light currently has six committees working for standardization in building materials, overhead distribution materials, conductor and conductor fittings, wiring materials, protective devices and metals. A committee on insulating and electrical devices will be added soon.

Contract Award Challenged

Grafe-Callahan Construction Co. of Nebraska lost its suit challenging a contract award for construction of Tunnel No. 1 on the Feather River project.

The state department of water resources awarded the contract to Frazier-Davis Construction Co. of St. Louis, Mo., at $2,069,000 but Grafe-Callahan, second low bidder, challenged the award on the ground Frazier-Davis bid included electrical work amounting to 1.14% of the total by a subcontractor who was not named. This was said by Grafe-Callahan to be in violation of bid regulations, which required naming of subs performing more than one-half of 1% of the total contract value.

State attorneys successfully defended the award to Frazier-Davis, citing a state law which asserts that when a subcontractor is not named the prime contractor agrees to go ahead with the work himself.

IBEW Chooses Officers

In a secret ballot mail referendum, Local 1245 of the International Brotherhood of Electrical Workers, whose members reside in 48 out of California's 58 counties and in northern Nevada, have chosen the officers who will lead the 10,000 member local for the next two years.

Ronald T. Weakley of Oakland was re-elected to his fifth consecutive two-year term as business manager-financial secretary.

Other election winners were: James E. Gibbs Jr., president; Marvin C. Brooks, vice-president; Loretta Olive Arneson, recording secretary; Allan C. Terk, treasurer. Elected to the executive board were Robert E. Staab from Santa Maria, Richard N. Sands from Castro Valley, Gerald F. Watson from Corning and John W. Michael from Point Reyes.

Local 1245 represents utility employees of the Pacific Gas and Electric Co., the Sierra Pacific Power Co. of Nevada, the Citizens Utilities Co. of California, the Needles Division of the California Pacific Utilities Co., the Sacramento Municipal Utility District, the maintenance employees of the Sacramento Transit Authority and the electric department employees of the Key System and the cities of Oakland, Alameda and Berkeley.

Brief Filed on Boundary Project

The city of Seattle has filed its initial brief with the FPC supporting its application for license to construct the 600,000-kw Boundary project on the Pend Oreille River in eastern Washington. The application is opposed by mining interests and the PUD of Pend Oreille County. This action is beginning to bring to a close one of the longest proceedings ever held before the Federal Power Commission. Final decision should be reached early in September. City Light engineers point out that power from the Boundary project can be produced cheaper than from any site remaining undeveloped in the Northwest.

Star Studded

Hollywood Boulevard's "Walk of Fame" will be lighted by 154 star-studded luminaires. Designed by Westinghouse, each fixture contains three 700-w Colortone de luxe white lamps, similar to the one shown. Attending the installation ceremony are Otto Meissner (left), director of the Los Angeles Bureau of Street Lighting, E. C. Martinez, area manager for the Westinghouse Bell Garden, Calif., office, and L. W. Luley, Westinghouse street lighting specialist. It is expected that light level will exceed 10 f-c, compared with the present 1.2 f-c. Pacific Union Metal Co. supplied the light pole extensions and supports, and Newbery Electric Corp. of Los Angeles is making the installation under Meissner

Wage Increase at Los Angeles

Salary increases totaling $1,839,000 annually will be given to 6,400 of the 10,500 Los Angeles Department of Water & Power employees under a new seniority formula adopted by the Board of Water & Power Commissioners.

A 5% increase in monthly salaries became effective July 11. Employees will now receive a wage boost after 3½ years of service in a specific job classification instead of after four years.

Not included in the increase are 1,100 workers in the engineering divisions that have been operating under a revised seniority program since 1956. Also excluded were the 12 highest paid department executives.

► **IBEW** Local No. 1823 signed a two-year contract with Climax Molybdenum Co., Climax, Colo., providing for a 14¢ hourly wage increase retroactive to July 15, 1960, and another 9¢ hourly on July 15, 1961. The contract includes higher rates for underground, night or swing shift work, hospitalization and pension benefits. Former hourly rate was $2.90.

► **A new two-year contract** calling for a 4½% general wage increase and further fringe benefits for 13,611 physical and clerical employees has been approved by the IBEW, AFL-CIO and the Pacific Gas and Electric Co. The agreement contains a midterm reopening clause on a general wage rate change only.

► The Richland city electrical department has signed a **new one-year contract with IBEW** Local 77, providing a 5¢ hourly pay boost for electricians and linemen. The new hourly rate is $3.40.

► **True cash value** of Oregon utility properties of all types is $1,124,956,212, an increase of 9% over 1959, according to the Oregon Tax Commission. The increase was caused by expansion in electric, gas and telephone properties.

ANOTHER STEP AHEAD IN VOLTAGE REGULATION

APPLICATION ENGINEERING

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Nuclear News

PRDC Decision to Supreme Court

The Atomic Energy Commission is requesting the Department of Justice to take the necessary legal steps in the United States Supreme Court for review of the June 10 decision by the U. S. Court of Appeals for the District of Columbia setting aside the commission's grant of a provisional construction permit to Power Reactor Development Corp. Inc. of Detroit, Mich., for the construction of a fast breeder power reactor at Lagoona, Mich. On July 25, 1960, the Court of Appeals denied the petition of the United States and PRDC for reconsideration by the entire court of its June 10 decision. PRDC has been permitted to continue work on the plant pending the outcome of this latest action.

Hearing Rescheduled for Construction Permit

Aug. 24, 1960, has been set as the date for a public hearing on the request of the Pacific Gas and Electric Co. for a construction permit for a 50-mw (electrical) boiling water reactor to be erected at its Humboldt Bay power plant near Eureka, Calif.

The hearing originally scheduled earlier was postponed at the request of the company so that it could complete further tests on the proposed pressure suppression system for the reactor. These tests have been successfully completed and PG and E has asked that a new hearing date be set.

Construction is expected to be completed in May 1962 at an estimated construction cost of $19,500,000.

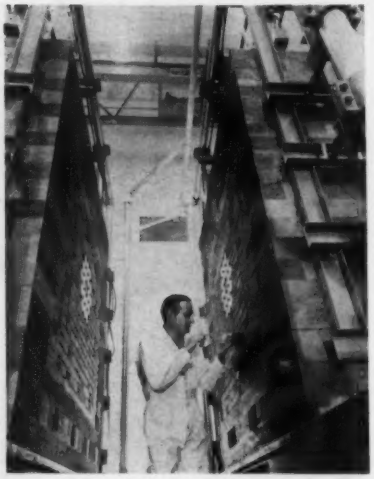
Philadelphia Electric Co. Peach Bottom Plant

During July, the Philadelphia Electric Co. filed with the AEC for a construction permit for the 40,000 kw high-temperature gas-cooled reactor to be completed at Peach Bottom, Pa., in 1963. This prototype plant will be built by the Philadelphia Electric Co. and 52 other investor-owned utility companies comprising High Temperature Reactor Development Associates Inc.

A new low-power nuclear assembly designed to study the nuclear characteristics of the reactor for this plant has achieved its first chain reaction at the John Jay Hopkins Laboratory of the General Atomic Division of General Dynamics Corp.

During June a Pennsylvania Public Utility Commission eminent domain order permitting the Philadelphia Electric Co. to acquire a transmission line right-of-way for this reactor project was affirmed by the Superior Court of Pennsylvania.

The landowner who had brought the suit questioned the safety of the proposed project. The court said that the safety of the plant was the responsibility of the AEC and was not an issue before the state utility commission.



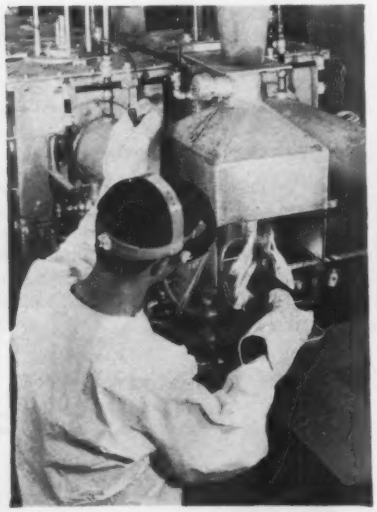
Bringing together these two sections of a new 25-ton nuclear assembly enables scientists at General Dynamics' General Atomic Division in San Diego to initiate a controlled nuclear chain reaction. The low-power assembly was designed and built to study the nuclear core characteristics of the high-temperature gas-cooled reactor. Here Dr. James Brown, physicist in charge of the facility, carefully positions an experimental fuel sample in one half of the assembly

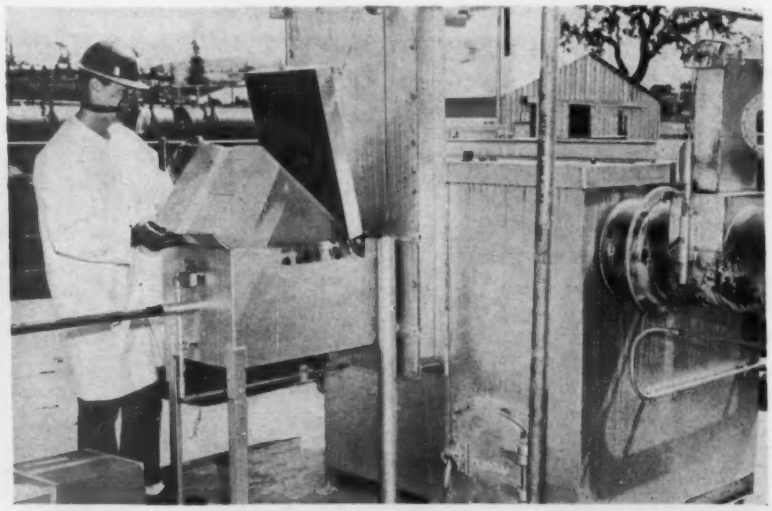
Latest Fad—Paper Suits

Paper clothing, including pants, coats and even a matching hat, is the latest thing in wearing apparel for personnel who work with radioactive materials at General Electric's nuclear equipment plant at San Jose, Calif.

Made of heavy duty fire and water

Technician wearing paper protective clothing (left) removes uranium dioxide fuel pellets from a sintering furnace in the Fuel Development Laboratory at General Electric's atomic plant at San Jose. Cost of the suits and their disposal in a special incinerator (right) is less than the expense of cleaning conventional clothing in an "atomic laundry"





resistant nylon threaded paper, the suits are being worn in controlled areas of the plant's nuclear fuel manufacturing operation, as well as in the company's Vallecitos Atomic Laboratory in Pleasanton, Calif.

They are worn only once or twice, then burned in a new incinerator specially designed for the disposal of materials which, like the paper clothes, might possibly have picked up some radioactive dust particles.

General Electric is presently using about 1,000 of these outfits each month. These suits cost about $1 each and are considerably less expensive than having normal work clothing cleaned in a special "atomic laundry."

High Energy Particle Accelerator

On July 29, 1960, the Alternating Gradient Sybchrotron (AGS) at Brookhaven National Laboratory was placed in operation and produced a beam of protons at an energy of more than 30 billion electron volts, the highest energy ever attained by a particle accelerator.

This machine now takes its place as one of the world's two largest operating particle accelerators. The other unit, which is similar in design and size, was placed in operation at the European Organization for Nuclear Research (CERN) Laboratory, near Geneva, Switzerland, during 1959 and has produced a proton beam with an energy of 28 billion electron volts.

Completion of the AGS at a cost of $31,000,000 will permit scientists in the United States to study nuclear interactions at energies about five times greater than before possible.

Construction of the AGS, which includes 240 magnets weighing 32,000 lb each placed in a ring-shaped, 18-ft-sq tunnel one-half mile in circumference, was started in 1955.

For a beam of protons to reach a final energy of 30 billion electron volts, approximately 300,000 trips around this "race track" must be made in one second. Toward the end of this one-second acceleration period, the protons are traveling at a velocity of more than 99.9% the velocity of light (186,000 miles per second). At this velocity the mass of the protons is 30 times its normal mass.

Market Development

PGE Sponsors Medallion At Oregon State Fair

Portland General Electric Co. will participate in construction, furnishing and publicizing of an Electric Gold Medallion Home at the Oregon State Fair Sept. 1-10.

According to W. L. Tait, manager of residential sales promotion, the State Fair house is being constructed on a platform and will be auctioned during the fair.

PGE is cooperating with Salem Home Builders Assn. and manufacturers in the promotion. Appliances will be by Frigidaire; Meier & Frank will furnish the house; Nichol Refrigeration of Beaverton will install a Fedders heat pump.

See What's Happened

With the slogan "See what's happened to TV," Northern California Electrical Bureau is running its third annual television promotion during September.

Top features of the promotion will be a retail sales contest with 111 prizes, valued at $4,125, according to Bert W. Reynolds, manager of the bureau. These include a grand prize of a seven-day Waikiki holiday for two; 10 Polaroid Land Cameras, complete with accessories, and 100 "Early Bird" cash prizes of $10 each to the first 100 salesmen who send their qualifying entry blanks to the bureau.

In addition to the prizes and complete informative materials, the bureau is supplying dealers with display materials in the form of acetate window banners and fluorescent counter cards, all carrying the campaign slogan. Pacific Gas and Electric Co. has scheduled intensive advertising support.

Participating manufacturers are: Admiral, DuMont, General Electric, Hoffman, Motorola, Packard-Bell, Philco, RCA-Victor, Sylvania, Trav-Ler, Westinghouse and Zenith.

► **Ruth Ward** has joined the staff of the Sacramento Municipal Utility District as sales promotion editor. She will be responsible for the publications *High Lines* and *Electricity Serves The Farm*. Doug Johnson, former *High Lines* editor, has assumed full-time duties in the general manager's office where he is assisting in public relations activities. Miss Ward at one time served as general assignment reporter and feature writer for *The Sacramento Bee* and was formerly publicity and news director for KCRA. She was public relations chief for the United Crusade just before joining SMUD.

Ward

Budget Plan For Electric Heat

Electric heat customers of Puget Sound Power & Light Co. now may pay their estimated annual bill in 11 equal payments, under a new budget payment plan instituted by the utility.

The new plan divides the bill into 11 payments running from July through May, relieving the customer of heavier bills during the cold winter months. Adjustments will be made during June.

The company now has about 15,000 electric heating customers, according to A. B. Couch, residential sales director.

Eight ranges were given away through cooperation of PCEA, Hawaii, at Honolulu's 1960 Home Show. Fourth such event, the show was sponsored by the Home Builders Assn. of Hawaii and drew 37,000 people to Ala Moana Shopping Center where it was held

Built around a utility core, SMUD's new $4,300,000 Service Center was designed for convenience, comfort and easy maintenance

SACRAMENTO'S ELECTRICAL LIVING CENTER

Camp Fire girls learn how to cook shish kebab from SMUD Home Economist Gene Boer. Junior cooking classes are held daily for eleven weeks each summer

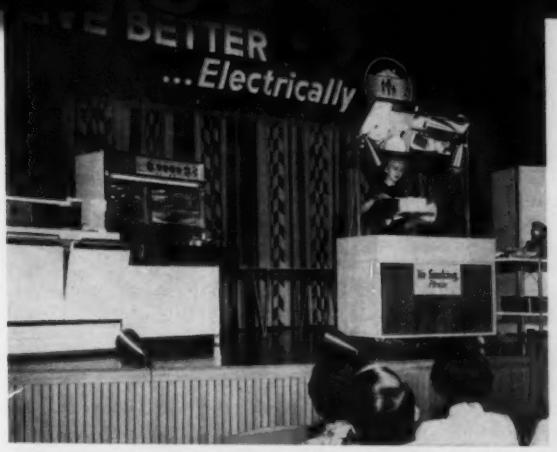
Customer service and load building are twin objectives in Sacramento Municipal Utility District's Electrical Living Center, a feature of its new office building. In this center Irene Couts, SMUD home economics director, and five assistants tell the story of electrical living to homemakers, to dealer salesmen and, in the summer time, to more than 300 teenagers.

Designed to take care of a heavy schedule (SMUD has an average of 2.2 meetings a day in the Living Center) the layout includes a demonstration kitchen and meeting room, which will seat 100 auditorium style and 60 to 70 at tables. An adjoining "work" kitchen permits home economists to prepare for an evening program while a morning or afternoon class is going on. Office space is conveniently placed just off this preparation kitchen.

Demonstrations that cannot be accommodated in the Living Center can be staged in the building auditorium, which seats 198. Stage equipment, rotated among manufacturers, is changed once a year. Behind stage appliances, of various makes, are changed as needed to keep equipment up to date.

It is not unusual to find this model kitchen in use morning, afternoon and evening. During the summer months, teenagers are taught fun and facts about food in classes held daily for groups of about 20. The same group attends three three-hour sessions a week. When the young people return to school in the fall, a homemakers course will start in the center.

For customers who do not get to the Electrical Living Center, a lobby appliance display carries the LBE message.



First dealer-sponsored cooking school in new Service Center auditorium drew capacity crowds two nights in succession

Chef schools give dealer salesmen pointers on use of electric appliances. Demonstration equipment is kept up to date

Home Economics Director Irene Couts, left, and Sara Bishop in the preparation kitchen adjoining the demonstration area

Rotating appliance displays in the main lobby of the building, changed every two months, tell the electric living story

Meeting room is used for utility demonstrations and for group social and business sessions. Equipment is changed each year

Washington Report

USBR Construction Schedule for 1961

The Bureau of Reclamation's construction schedule for 39 continuing and six new construction projects—totaling $294 million—during fiscal year 1961 was released in early August, showing an $88 million increase over funds for the previous year.

Most of the increase is directly attributable to the costs at several large multipurpose projects where construction is now in its heaviest pace. Trinity Dam, Calif., and Glen Canyon Dam, Ariz., together account for about $100 million.

Here's a rundown of work schedules calling for electrical equipment at projects where power generation is involved (dollar figures include all work planned at the project for fiscal 1961):

Pacific Northwest — Chief Joseph Dam, Greater Wenatchee Division, Wash., **$2,010,000,** awarding of contracts for pumping facilities; **Minidoka project,** North Side Pumping Division, Idaho, **$710,000,** complete installation of power factor improvement equipment for pumping power delivery facilities; **Burns Creek Dam,** Palisades project, Idaho, **$487,500,** initial construction and procurement contracts—provided House of Representatives approves authorization measure.

Central and northern California, southern Oregon — Central Valley project, Calif., **$52,586,000,** about 85% of this goes toward completion of Trinity Dam; also funds to start work on Whiskeytown Dam and to award power plant contracts for Trinity, Spring Creek, Clear Creek and Lewiston Dams, start of construction on power lines between these four hydro power plants and Keswick substation, plus added substations, planning on possible lines to the south—including negotiations with Pacific Gas and Electric on wheeling of federal power south from Cottonwood substation.

Pacific Southwest — Parker-Davis project, Ariz.-Calif.-Nev., **$415,000,** replacements and additions to Mesa and Phoenix substations and issuance of specifications for Davis Dam switchyard equipment; **Hoover Dam,** Ariz.-Nev., **$2,871,000,** continued installation of final hydro turbine and generator plus issuance and awards of minor contracts for related equipment.

Upper Colorado River Basin — Collbran project, Colo., **$5,163,000,** continued construction on upper and lower Molina hydro power plants and interconnecting power line; **Glen Canyon Dam,** Ariz.-Utah, **$53,529,000,** continued pouring of concrete at dam plus continued construction on hydro power plant and switchyard, also awarding of contracts for power plant generators, governors, cranes and fixed-wheel gates; **Flaming Gorge Dam,** Utah-Wyo., **$12,809,000,** start pouring concrete at dam plus continuation of work on power plant and switchyard, also awarding of contracts for generators and hydro turbines; **Upper Colorado Transmission Division, $5,637,000,** start work on 230-kv line between Glen Canyon and Curecanti Dams, start work on 115-kv line between Flaming Gorge Dam and Oak Creek; **Curecanti project,** Colo., **$1,400,000,** securing of field data and preparation of designs and specifications for Blue Mesa Dam and power plant to permit prime contract awarding in early 1962.

Upper Missouri River Basin—Yellowtail Dam, Mont.-Wyo., **$2,500,000,** awarding of contract and start of work on the dam, preconstruction work will be started on the power plant and switchyard; **Missouri Basin Transmission Division, $22,535,000,** award contracts for power lines between Sioux City and Creston, Sioux City and Spencer, Fort Thompson and Watertown, Oahe Dam and Fort Thompson; initiation of work on Denison, Spencer, Morris, Wiota-Wolf Point substations, plus initiation of work on additions to Sioux City and Wiota substations; continuation of work on power lines between Jamestown-Grand Forks, Jamestown-Fargo, Jamestown-Garrison Dam, Garrison Dam-Rugby, Fort Randall Dam-Sioux City, plus continued work on new substations at Creston and Fort Thompson and continued work on additions to substations at Fargo, Grand Forks, Jamestown, Rugby, Huron and Watertown substations; completion of work on power lines between Fort Peck-Dawson County, Bismarck-Jamestown, Bismarck-Dawson County, completion of terminal facilities at Granite Falls substation, and completion of additions to substations at Bismarck, Carrington, Devils Lake, Edgely and Rapid City.

Lower Missouri River Basin—Glendo Unity, Wyo., **$995,000,** completion of Gray Reef Dam and Fremont Canyon power plant and switchyard; **Missouri Basin Transmission Division, $2,071,000,** purchase of equipment for Thermopolis, Lowell and Raderville substations, continued work on Pine Bluff-Sidney and Pine Bluff-Cheyenne transmission lines, completion of Chadron substation, additions to Cheyenne and Ralson substations and completion of work on Kortes-Cheyenne power line.

Canadian Gas Imports

An immediate start on preliminary work to import 584,500,000 cu ft of Canadian natural gas daily into five Western states has been planned by eight companies, following approval of the project in early August by the FPC.

Biggest customer of the Canadian gas will be Pacific Gas and Electric, which will get 418 million cu ft daily of the gas through its Canadian subsidiary, Alberta & Southern Gas, and its U. S. subsidiary, Pacific Gas Transmission. PG and E's pipeline from Canada to the Oregon-California border will account for $133 million of the estimated $400 million total project cost. And PG and E will spend another $64 million on pipeline facilities in California.

Alberta & Southern also will deliver about 30 million cu ft daily of Canadian gas to Montana Power Co. Montana Power will spend about $2,600,000 for pipeline facilities in Montana.

Another 136,500,000 cu ft of gas will be delivered, via Pacific Gas Transmission's new line, to El Paso Natural Gas Co. near Spokane, Wash. Other companies in the project are Alberta Natural Gas, Alberta Gas Trunkline, Westcoast Transmission and Canadian Pipe Line—all in Canada.

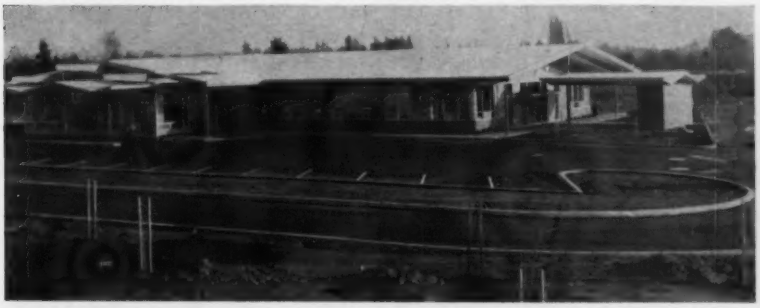
Bridge Canyon Hearings Rescheduled

FPC Presiding Examiner William Costello expects to reschedule FPC hearings on the Bridge Canyon, Ariz., hydro power license application fight for Jan. 9, 1961. Hearings had been set for Sept. 12, but canceled at the request of both parties —City of Los Angeles and Arizona Power Authority.

Costello probably will hold a prehearing conference on or about Sept. 12, to discuss procedures in the case and hearings.

In the meantime, the U. S. Supreme Court is considering the recommendations of its special master's report on division of Colorado River waters: the "Rifkin Report." The court probably will not rule until late this year or early in 1961.

Growth



Puget Sound Power & Light Co. has moved its Southern Division headquarters into this new building in Olympia, Wash., at 2703 Pacific Ave. Costing nearly $350,000, the building includes a drive-in cashier's window and a night depository

► **Missoula Electric Cooperative,** Missoula, Mont., has been granted a $585,000 loan from the REA to construct 39 miles of distribution line to serve 182 new customers, two new substations, a new branch office at Seeley Lake, Mont., and other improvements. Initial project will be the extension of the co-op's service in the Lolo Creek area, according to E. F. Pike, manager. Work will start in the spring of 1961.

► **Benton County PUD** has awarded a $214,000 contract to Jensen-Rassmussen Co., Sunnyside, Wash., for construction of a new **service center building in Kennewick.** The project will be located at 15th and Ely Streets in Kennewick and will consist of a warehouse, office building for maintenance personnel and shops for maintenance of automotive and electrical equipment.

► **Douglas County PUD** reports that survey and aerial mapping work is under way in connection with the PUD's plans to seek a license for the Wells Dam project on the Columbia River near Azwell, Wash.

► **Fluor Corp.** has been awarded a contract leading to the design and construction of a second steam-electric generating unit at California Electric Power Co.'s Cool Water plant near Barstow. The 60,000-kw unit will cost an estimated $10 million. The initial unit is already under construction at a cost of $14 million and is scheduled for completion in mid-1961. Construction on the second unit will begin in early 1962, with completion scheduled by the middle of 1963.

► **B. C. Power Commission** announces a preliminary topographical survey has been made for a second possible **hydroelectric development in the Clearwater River area** of B. C. The site under investigation is at Flourmill Creek, upstream from the confluence of the Murtle and Clearwater Rivers. The first site under study by the commission is at Pyramid Mountain, near the confluence of the two rivers.

► Preparation of final plans for the $8,000,000 **Packwood Lake hydroelectric project** was ordered by the **Washington Public Power Supply System,** after acceptance of an FPC license for the 12,000-kw project. Plans will be prepared by R. W. Beck & Associates, Seattle, with calling of construction bids scheduled for next January.

► Work will begin on the first tunnel in the $630 million **Peace River hydro project** this fall or early next winter. **Peace River Power Development Co.** President W. C. Mainwaring said at Vancouver, B. C., that start of actual heavy construction for the first dam is still scheduled for 1962.

► **California Electric Power** Co. has awarded the **Fluor Corp.** Ltd. a contract to perform the engineering, materials procurement and construction of a second 60,000-kw unit at **Calectric's** Cool Water steam electric generating plant in the Mojave Desert near Daggett, Calif. The total estimated cost of this work is approximately $10 million.

► Assembly work is under way on the first generating unit of the **Burrard thermal plant** of B. C. Electric Co.

► The final 62,000-kw generator has been installed at **B. C. Electric Co.'s Bridge River power plant** bringing the Bridge River area capacity to nearly 500,000 kw.

Communications

► **New British supervisory control system** is described in the June issue of *British Power Engineering.* It uses a "heavily coded and fully interlocked voice frequency signaling system, together with an automatic announcement unit." The system, called Datafonic, uses normal telephone trunk circuits exclusively in order to save the cost of private circuits—a philosophy exactly opposite that expressed by the Swedish engineers in last month's Communications column. Full use is made of supervision, control, telemetering and alarm functions.

Most unusual feature of system is use of voice recordings to identify the outlying station, both when called and when originating a call to the master station. In addition, certain alarms are given verbally. Apparently a sophisticated version of the automatic answering tape recorder device must be used and, while this is a very redundant means of transmitting information, it probably has a better chance of getting through distorted or noisy voice circuits.

Communications engineers in this country would certainly be delighted if they were able or, to be exact, allowed to make use of their ingenuity and provide similar simple alarm systems that could be attached to telephone extensions at small substations and power plants. Unfortunately, Bell System practices do not permit such attachments unless they can supply them.

► **Microwave technical standards** are specified in a report and order on Docket 13082, dated July 20, 1960, to become effective Jan. 1, 1961. The commission, however, stated that equipment now in operation or authorized prior to the effective date of the docket could continue in operation until it caused harmful interference to a station operating under the new standards. Compliance with the new standards would then be required. The very tight frequency tolerances originally

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proposed have been relaxed somewhat in response to the cries of pain from both manufacturers and users. While desirable, these tolerances were either beyond the present state of the art or beyond the pocketbook of the user. Power, bandwidth, etc., were generally acceptable as originally proposed and suffered little change. The commission stated that the specs were of an interim nature to insure a smooth transition into the finalizing of Docket 11866, which would—some day—remove microwave from its present developmental status and place it on a regular basis. Since 30 days are allowed after the release of an order in which to file protests, it is likely that someone will take issue with a part of it and further delay the effective application of the standards.

► **Kenneth A. Timm,** Idaho Power Co.'s assistant communications engineer, died in Boise Aug. 2. He joined Idaho Power Co. in 1949 after graduation from college following service in the war. He was a member of the National and Idaho Society of Professional Engineers and well-known in the Northwest, particularly by members of the Northwest Power Pool Communications Engineers, where his technical ability and leadership will be missed at the regular meetings.

► **Movable base radio stations** and operational fixed stations authorized to operate at temporary locations will enjoy relaxed log-keeping regulations effective Aug. 6. Operators will no longer have to sign on and off duty on a daily basis, nor will a record of communications with base stations be required. This modification was petitioned of the FCC by the petroleum users who make more frequent use of this type of station than electric utilities. The exact requirements are covered in Part 11 and, don't forget, an up-to-date copy of Part 11 must be available for your system or at your base station.

► **An emergency backup radio network** is being investigated by utilities of the Northwest Power Pool. Initial tests between Portland and Seattle in the 40-mc band have proved successful; however, Spokane either to Portland or Seattle will involve crossing over some mountains, which may prove difficult. A study is now being made to determine if there are any natural formations that can be used to produce a knife-edge refraction path. If successful, this will be one of the few such paths in operation.

Association Affairs

NAED Convention

"Partners in Business" is the theme of the 52nd Western Region convention of National Association of Electrical Distributors, which will be held at Stardust Hotel, Las Vegas, Oct. 18-21, just prior to the NECA national convention. To implement the theme, arrangements are being made to set aside one day for each group to discuss his particular part of such a relationship. Manufacturers and their agents have been assigned first day, distributors, both large and small, the second day, and customers — industrial, utility, contractor and retail — will have the third day's program time.

The Western Region meeting will be presided over by K. P. Rehwaldt, General Electric Supply Co., Los Angeles, regional vice-president. Members of the NAED board of governors for the region will also be prominent in the proceedings. E. C. Phillips, Coast Electric Co., San Diego, Earl E. Morton, Westinghouse Electric Supply Co., San Francisco, and John P. Lawton, Graybar Electric Co., Seattle, are the board members.

In general, Tuesday's meeting will be for members. The Wednesday, Thursday and Friday meetings will be held in the morning for members and guests. Nongolfers will have available workshop sessions dealing with commodity problems each afternoon. A banquet luncheon will conclude the affair Friday noon. W. M. Jewell, NAED Western Region manager, San Francisco, is handling arrangements for public space and suites.

IAEI

New Mexico Chapter of International Association of Electrical Inspectors, which recently joined the Southwestern Section, was visited for its July 14 meeting in Albuquerque by Ernest Nelson, president of the section, of San Leandro, and Lou La Fehr, secretary-treasurer, Alhambra. E. S. Butt of the state administrative board, chairman of the chapter, presided. After a talk on electrical accidents and resuscitation methods, most of the meeting was devoted to code problems—a discussion in which President Nelson took a very important part.

Changing officers at the Utah Chapter, IAEI. Standing: V. C. DuVander, new second vice-chairman; William Whetton, retiring chairman; Lloyd M. Grames, new chairman; J. A. Clinger, first vice-chairman. Seated: A. H. Bywater, retiring secretary; and Theron Haws, new secretary-treasurer

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34.5	1,500,000	1,250,000
46	1,750,000	1,250,000
69	2,000,000	1,500,000
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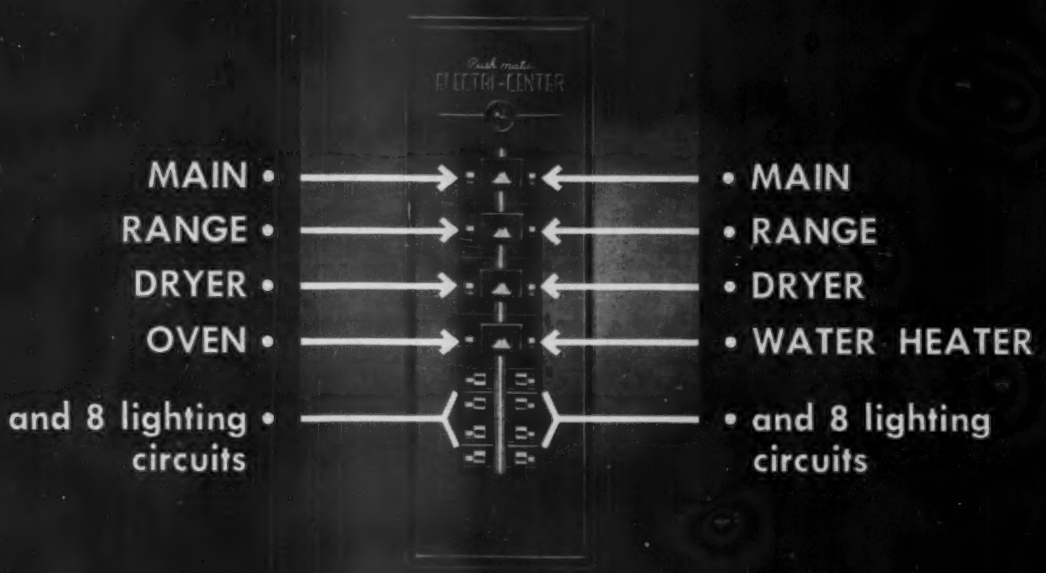

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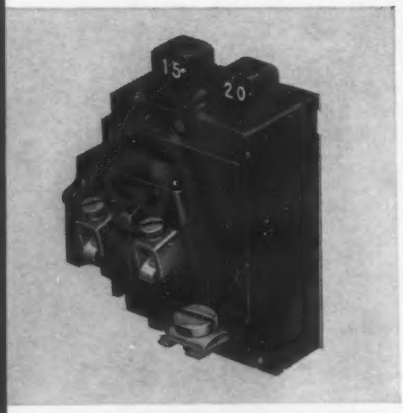

New Duplex Pushmatic puts two circuits in the space of one single breaker. Gives: identical, independent coil-magnetic protection in each pole of all Duplex breakers; positive one-bolt connection; pushbutton convenience.

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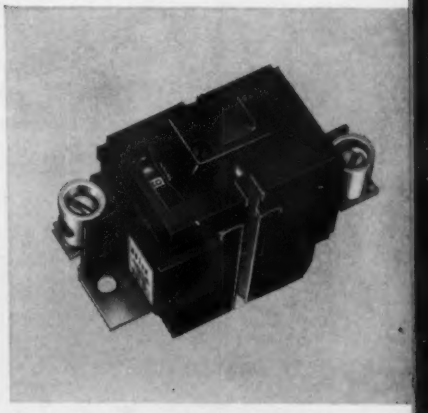

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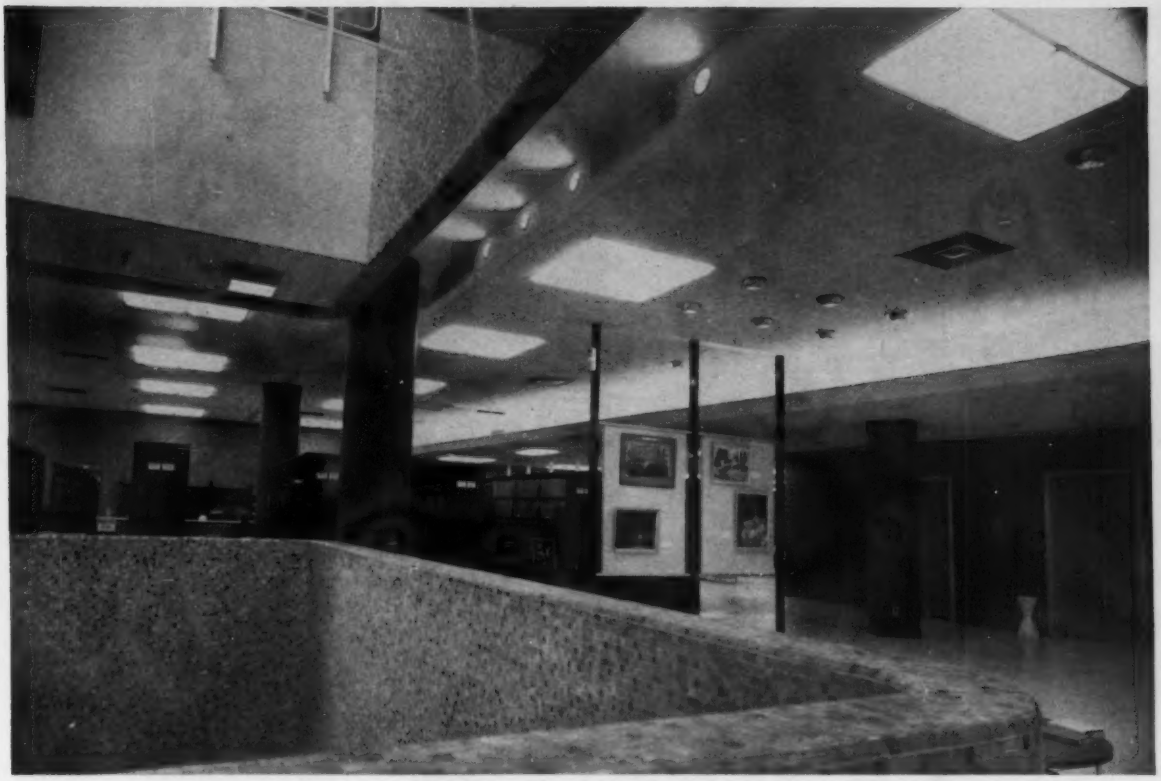
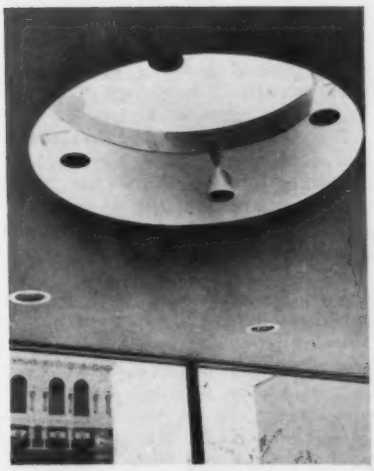
ELECTRICAL WEST SPOKESMAN FOR MOST HIGHLY ELECTRIFIED REGION OF THE U. S. VOL. 125, NO. 3 SEPTEMBER 1960



A variety of methods were used to suit areas and their particular seeing needs as shown around the center stair well

Finest "Illuminating Engineering Practice" was employed for the lighting of

SEATTLE'S NEW LIBRARY



Nighttime lighting over the sky and window lighted stair well is done with down floods in ceiling and sky dome

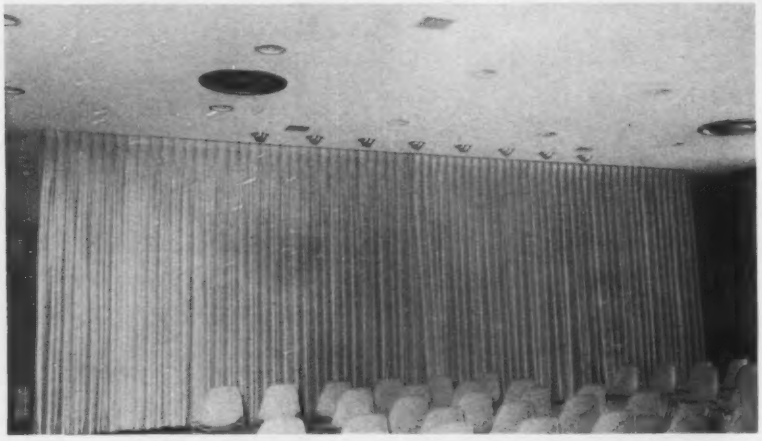
Libraries of old were generally in dark cloistered rooms where scholars strained to read by the light of the original foot-candle, or so it seemed. But today's most modern libraries are made so attractive to read in that the public is returning to books and their circulation is increasing. So at least is the experience at Seattle in its new main library, built last year on the same hillside block as its previous "cloistered" old one. But what a difference!

It is the well-engineered lighting by Beverly A. Travis and his associates, electrical engineers, that accounts for a major share of that difference. For it was designed under the recommended standards of the Illuminating Engineering Society of which Travis has been Pacific Northwest regional vice-president, and his associates active in the society. The architects, Bindon & Wright, and Decker, Christenson & Kitchin, associated architects, were sympathetic to lighting, with the satisfactory result now attained. Electrical installation was by Industrial Electric Co. of Seattle, with personal supervision by Harold Kieburtz.

Although the building is encased almost completely in glass, a dark-

Fifth Avenue side has an underwater-lighted fountain

Fourth Avenue entrance with ornamental bubbles for decor



Unobtrusive ceiling units light small auditorium and eyeballs light stage

Windows and ceiling panels give children's section a cheery open atmosphere

ened glass is used for fenestration to reduce the brightness of the daylight and aid in balancing it with the interior illumination. General lighting is provided from 4x4-ft recessed, eight 40-w rapid-start fluorescent lamped fixtures with four 2x2-ft acrylic diffusing panels on approximately 12x12-ft spacing. Each unit is on two circuits to permit switching staggered lamps separately for half on, half off.

These lighting units are used in the three public floor ceilings. With low-voltage switching, it is also arranged that a band of fixtures may be switched on to form a band of light around the perimeter of the upper floors for night decorative effect. Low-voltage switching of the 277-v general lighting system also permits custodians to turn on or off the light in areas worked in.

Five floors, a basement and a subbasement constitute the present building but provision has been made, structurally and electrically, for the future addition of three more floors. Its first three floors occupy the 30-ft drop between Fifth and Fourth Avenues and thus there are entrances on both levels to the street. These floors are used for public reading rooms and book stacks. Storage stacks, as well as mechanical equipment, are in the basements. Offices and library service areas are on the fourth and fifth floors in a narrower rectangular structure rising above the base structure. A portion of the old structure was incorporated on the Fifth-Avenue side.

Lighting in the service structure employs the same kind of fixtures except that, instead of being arranged in 4x4-ft panels, they are run end to end in continuous rows so that they may provide illumination for various-sized offices or working areas made with movable partitions as required. In the office of Willard O. Youngs, director of Seattle's library system, as well as in a conference room for the library board, luminous ceilings are made up of the same fixtures grouped together. All lighting fixtures are mounted in the acoustical ceiling grid.

Many special areas requiring individual treatment are provided appropriate lighting. One such is that over the electric moving stairway well from the first to third floors. It comes up into a lobby area on the third floor level principally lighted during daytime by a number of Plexiglas domes in the roof. Two of these are over the escalator well. To supplement the daylight on dull days and to do all the lighting at night are four decorative cone fixtures with reflector lamps in each dome. These are supplemented by flush-mounted downlights in the ceiling.

Other areas, such as in front of the elevators, which has a dropped ceiling for structural reasons, have downlights also although sparing use is made of such direct illumination. Eyeball adjustable units are employed to direct light on screens used both for room dividers and for mounting pictures, paintings or maps.

For the relamping of the fixtures in the skylight domes, as well as to clean the dome itself, an ingenious portable aluminum pipe scaffolding has been provided. It can be set up piece by piece over the escalator well and is made to roll along the parapet wall. After use it is taken apart and stored in the basement.

To light the outside of the parapet wall projecting down into the second floor, a row of louvered flush mounted floodlamp units have been installed. To add to the general illumination as well as tie the two parts of the area together, an indirect cove with fluorescent lamps has been made along the edge of the dropped ceiling in front of the elevators.

Connected to the main building by the third floor lobby is an adult education wing containing a small auditorium for lectures, plays or meetings. With a movable curtain across its center, it can be divided into two rooms. So the lighting for this area is arranged to be switched, by means of low-voltage relays, from several points. These include each of the two entrances as well as the stage or the projection room. The lighting is all done from built-in ceiling downlights or eyeball spots in front of the curtain. All lighting in the room is on remote dimmer control. A panel backstage for the dimmers and relays and another for the sound system are each operable from the projection room at the other end of the room.

General reading areas and stacks are lighted by ceiling panels plus windows

For exterior illumination the building depends chiefly on spill of light from the interior through the large window areas. More for decorative effect than illumination, the architects had clear Plexiglas bubbles with clear incandescent lamps ranged along the Fourth-Avenue front. Downlights in the entrance lobby add light to the area. In the planting are garden units with a flat bowl shield below eye level. A fountain at the Fifth-Avenue entrance, with underwater lighting, contributes attractive decoration there. Between each of the mullions between windows on the upper three floors, an aluminum cone fixture with a 150-w PAR-38 points down the face of the building. These are operated by photoelectric control and are relamped by swinging the fixture bracket up over the roof parapet.

Interior foot-candle levels average 100 f-c in open reading areas, around 65 f-c in stack areas where the books and stacks are darker than the room finishes, with about 25 f-c vertical on the books. Separate 277-v and 120/208-v systems supply the fluorescent and incandescent lighting.

Basement storage has prismatic units between stacks, fluorescent over aisles

PHOTOS BY ROGER STURTEVANT

Inside room at Hillsdale, lighted both by skylight and surrounding fluorescent units

How an architect views

SCHOOL LIGHTING

BURTON L. ROCKWELL, JR., AIA. REID. ROCKWELL. BANWELL & TARICS

Illumination has long been regarded as one of the most important factors in school design. A concern for proper illumination has, however, led to some improper results, such as legislation enforcing a given ceiling height. When bilateral natural lighting provided a way of securing acceptable illumination with lower ceilings, such legislation had to be removed from the statute books — after the inevitable harmful delay. But whether it has been 12-ft-high ceilings with unilateral lighting or bilateral lighting or skylights or artificial illumination without windows or skylights, a given system has usually appeared to its special advocates to be "the real answer." Along with various forms of illumination, various levels and qualities of illumination have been adopted at various times as rigid standards. I hope that the record of frequent change in standards will lead to less dogmatism than is evident even now.

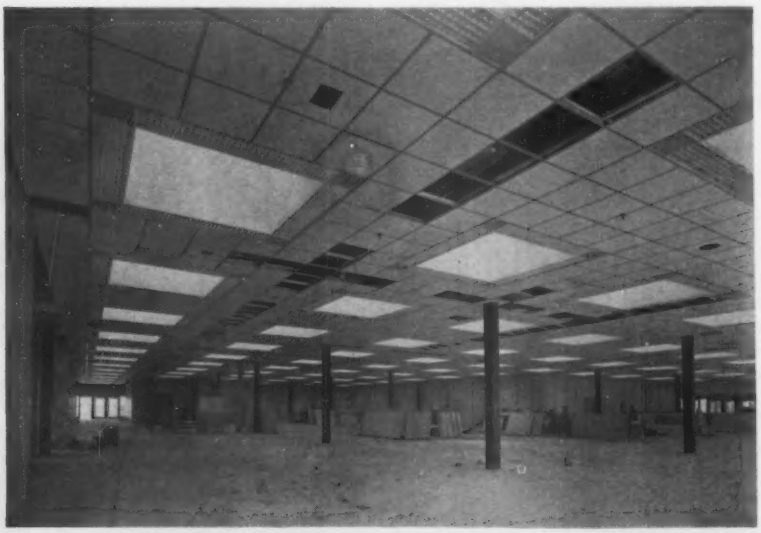
A dogmatic view is often expected and desired from the architect. Instead of being asked to be as clear as possible about what is reasonably certain, he is asked to pronounce sweeping and positive judgments. My partners and I, having designed schools with windowless classrooms, are often asked to explain why we are so sure classrooms without windows are better than classrooms with windows; having designed classrooms with only artificial illumination, we are asked why we are so sure artificial illumination is better than natural. There is no logical answer. We are not so sure.

We do believe that intensity, distribution, brightness and fluctuation are more easily controlled with artificial illumination than with natural. We have discovered that where there is an activity center of sufficient interest within a classroom a windowless room will often be preferred to a windowed one. These conclusions and many others gained from study, experiment and observation lead to successful design only when they are held tentatively and the limits within which they are valid are kept well in mind.

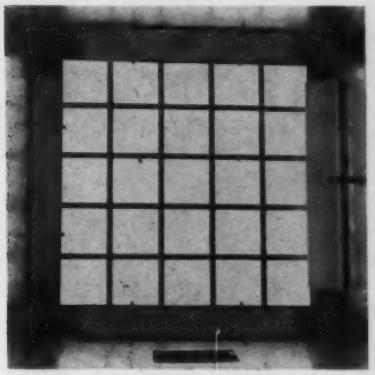
The best type of illumination must be determined *in each instance* in relation to what we are trying to do. How do we define our objective? Are we principally concerned to assure enough light for visual acuity in a specific task; to avoid visual obstacles such as reflection and glare; to spend as little as possible for a good job; or just to spend as little as possible?

Much school illumination develops from such objectives. Such objectives are not basic. Basically illumination is part of a building, part of an environment. There is no single factor more important than illumination. But as important as this factor is, the environment as a whole is more important. Illumination, ventilation, heating, cooling; color, texture, material; proportion, contrast, refinement; convenience, utility, durability; and many other factors contribute willy-nilly to the environment. One doesn't consciously push them along, first one and then the next, keeping an even front as the solution advances, but no factor, least of all illumination, should be treated independently.

An instance of the type of planning which my partners and I commend occurred in the design of the Hillsdale High School for the San Mateo Union High School District. In this instance the programming by the district superintendent, Thomas F. Reynolds, and his staff and ad-



Modular pattern of skylight wells with lighting units around each in expansive area permits changing of classroom sizes and arrangement by moving partitions



SMITH STUDIO

At Mills school four three-lamp plastic shielded units were mounted inside the skylight wells, covered by grid of glass blocks to make these wells the sole source of illumination and reduce brightnesses

visors was so thorough and the objectives of the board of directors, under the chairmanship of Carleton Herrman, were so clear that we were especially challenged to do something that had not, to our knowledge, been done before.

This something that had not been done before was, briefly, to design a school which without restricting the programs of the future could continue in use for generations. Many schools have continued in use for generations but with increasing restrictions on the constantly developing and changing programs.

The solution, of course, was a perennial one: flexibility. I suppose flexibility has been sought and claimed since the earliest days of architects. It is a commonplace objective. It can, however, be realized only to varying degrees, always leaving something unrealized and therefore remaining for us valid: commonplace but not merely commonplace.

Our search for flexibility led us through a long cooperative planning period to square classroom units each of 49 bays, 28x28; divided by movable partitions into classrooms of various sizes, ventilated and heated by a double-duct air system and illuminated by prismatic glass block skylights supplemented by fluorescent lamp fixtures in a square band around each skylight.

Now each of the elements in this solution had developed with simultaneous study of the other elements. The structure, two-directional rigid frames of structural steel with steel roof deck diaphragms, was selected for its appropriateness to a plan of 28x28-ft modular units arranged in depth; the ventilation system was selected for the special demands of classrooms without exterior walls. The glass block skylights were selected as the best available type of overhead lighting. (The windows, I might note, were not eliminated in order to use this type of illumination.) The artificial illumination was designed to augment the daylight when days are short and to provide for evening use. The arrangement of the ducts, supply grilles, exhaust grilles, lighting fixtures, fire-sprinkler heads, ceiling panel system, movable partition system, exterior wall assembly system were themselves components in an integrated system, and not independent arrangements and solutions. It is impossible to say which portion of the resulting design came first. There was no time, for example, when the illuminating engineer, the late Charles Von Bergen, was called in. He was in from the beginning.

The best lighting, the best environment, I feel sure result from a working together to implement a commonly understood concept.

The acceptance of the Hillsdale High School was gratifying. The illumination proved to exceed the quantitative and qualitative criteria we had set up. Since then we have had the opportunity to design three more complete high schools for this district. Each has been, on instructions from the district, of this same concept.

Of these later schools the Mills High School has been completed and in use for nearly two years. In this school a prismatic glass block of higher light transmission was used, thereby permitting smaller skylights. The fixtures were located up in the skylight wells where at the price of a lower efficiency the artificial illumination blends more effectively with the natural.

At Aragon High School, now under construction, this illumination combination was retained for more than half the classrooms. To meet a more stringent budget, however, the natural illumination was deleted from the classrooms of lower-use frequency, such as shops and music. In these areas artificial lighting will be used exclusively. Quantitatively the light will be, we are sure, equal to the best we have achieved. Qualitatively, the light will be, we believe, good, basing our belief on our increasing experience with classrooms lighted solely by artificial illumination. Whether it will be equal to our best we don't know. Conceived without limiting circumstances, a classroom benefits, I believe, from some natural illumination. Conceived with the restrictions of available funds, conceived with the need for night use where high quality artificial illumination must be provided anyway, classrooms may well be designed without natural illumination.

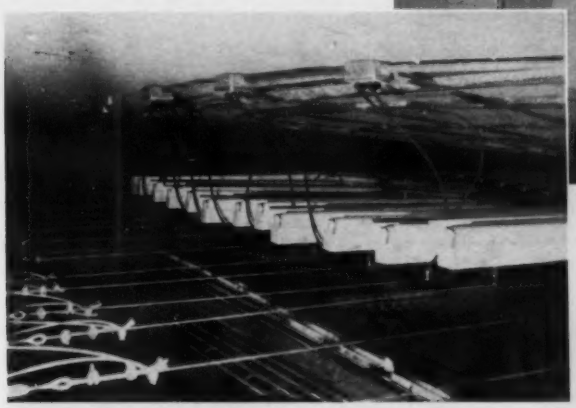
The first requirement I would set for good illumination would be to have a concept of the environment. We must know clearly, far more clearly than we often do, what we intend to do. The second requirement would be to recognize how little we know certainly and finally, how few precedents are safely followed. The third requirement would be to keep well in mind how much a proper environment, a well illuminated environment, contributes to well being, how worth the while the effort is.

LIGHTING

New technique in roadway illumination (above) at Washington State Ferries' Anacortes dock makes use of 51 mercury Wide-lites along approaches and to cover parking area. Crossarms carry the primary to transformer banks; the secondary runs on racks. Emeryville's half-mile San Pablo Avenue (left) relighted with 54 1,000-w color corrected mercury G-E units on 32-ft aluminum poles, 100 ft apart, saves lives with 9 f-c on its pavements, highest level in the state

In San Jose's nine-hole Ironwood golf course 109 G-E floodlights, 1,500-w incandescent on a 277/480-v system because of long feeders, provide 5 f-c on fairways and tees and 10 f-c on greens. Units, four to six on a 40-ft pole for greens; two to five for fairways cover the 1,650-yd course, the first in northern California for many years, and best lighted

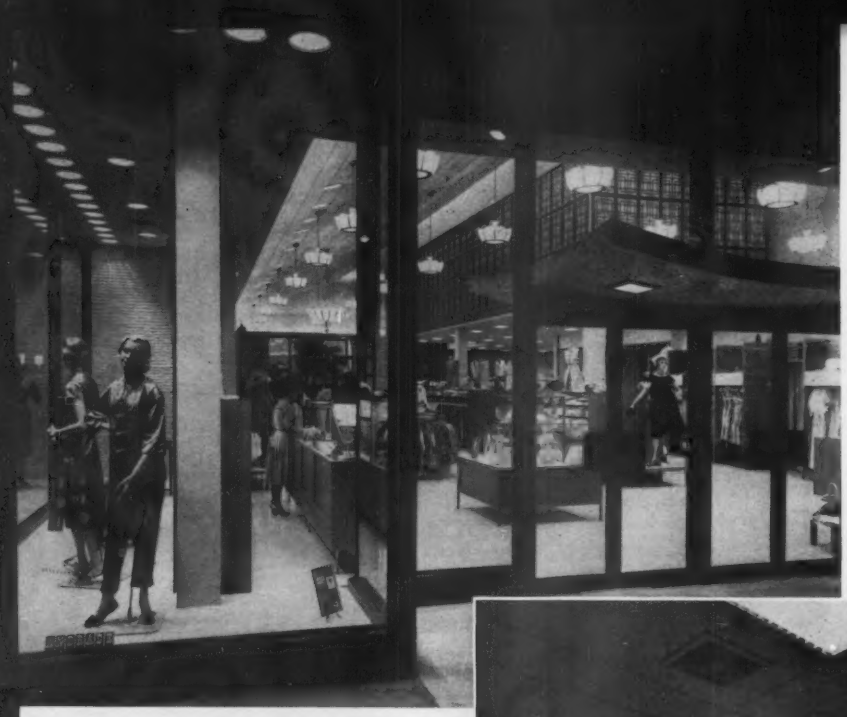
Skylight in California Pacific Title Insurance Co., San Francisco, was unreliable for lighting so was roofed over and Smith Electric installed reflectored strips of fluorescent units on messenger cables one foot apart above the glass, which now assures reliable and even distribution day or night. They can be pulled to the edge for relamping or servicing



OUTDOORS AND IN

Back wood panel wall of customer service section of First Federal Savings & Loan in Salt Lake City (right) is lighted by two-lamp fluorescent strips in vertical coves. With rows of 2x4- and 4x4-ft recessed, prismatic lensed ceiling units, tellers' windows receive 100 f-c of diffused illumination. Along the outside lower inset wall of Sacramento Municipal Utility District's new building, a mural is illuminated at night as an attractive element of the building design. A fluorescent troffer in the walkway ceiling provides the light and for the sidewalk it is augmented with downlights

in BUSINESS

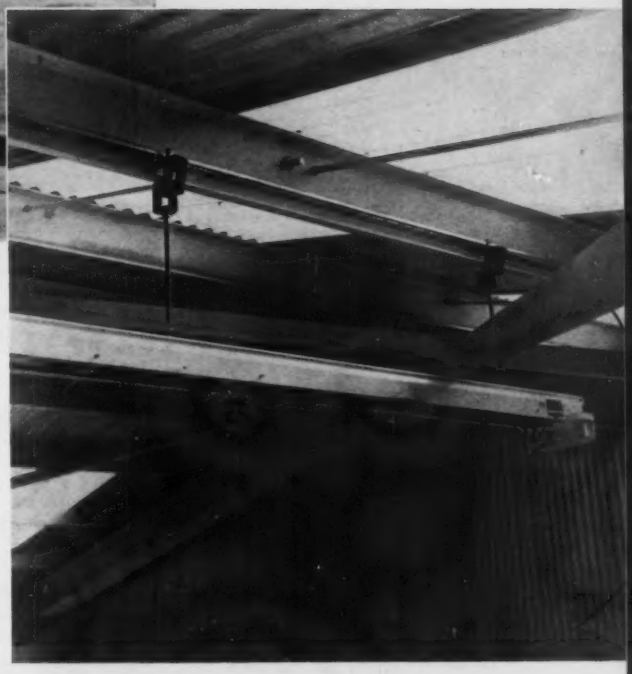


Dramatic use of lighting in Andrade's Shop in Honolulu's Ala Moana Center attracts and stimulates sales. Many methods are used (above). Fluorescent coves illuminate parts of the ceiling. Recessed and louvered incandescents build up light on merchandise unobtrusively. Specially designed suspended incandescent luminaires with lens bottoms and some upward component supplement general illumination and add eye appeal. Not shown; a small shoe-fitting alcove receives high intensity from a louvered ceiling and fluorescent lamps above it

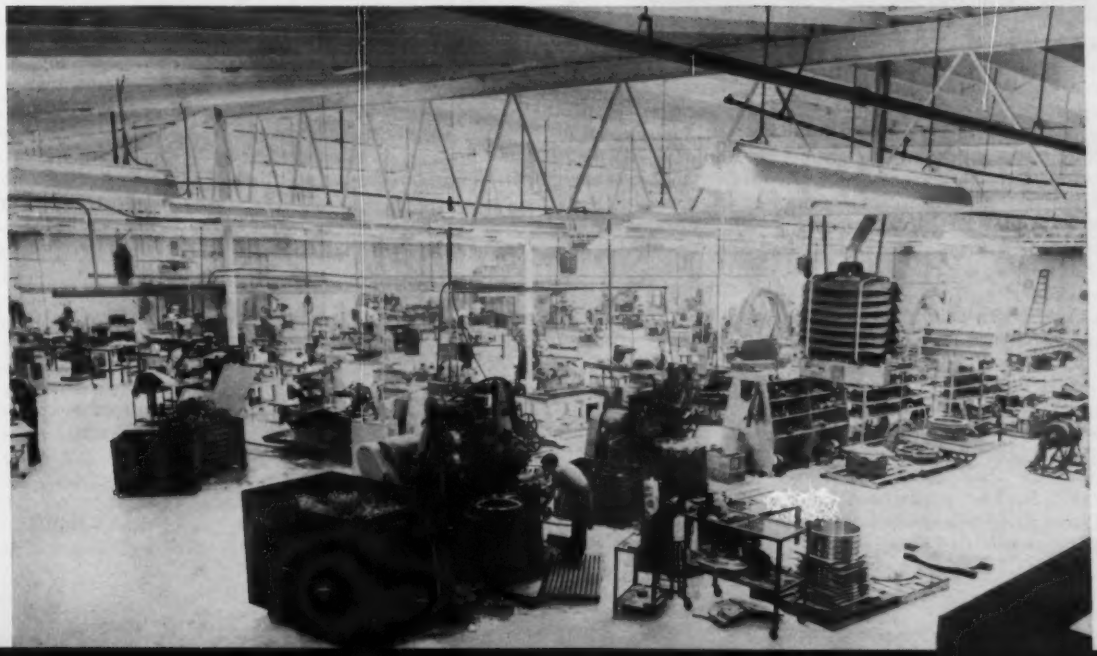
Shopping centers compete with each other as do the merchants within them. Lighting is one of the chief sales attractions. In the Riverside Plaza, Riverside, Calif., the pictures above and at left represent in two of the many stores some lighting techniques employed. This entire project was lighted by a variety of Curtis-AllBrite units. Above is a service area, the credit department, of Harris Co. department store, with 80 f-c average from louvered flush-mounted panels. At left, the Thom McAn shoe store given 75 f-c of general lighting by continuous row troffers with accent light on merchandise in alcoves from ornate cone incandescent spots. Each store in the center has somewhat different lighting treatment

and

INDUSTRY



When Chicago Bridge & Iron Co. added to its Salt Lake City plant a 180x480-ft extension, it had Oberg Electric continue its 480-v distribution for motors to handle the lighting with two-lamp, 8-ft industrial fixtures with Power Groove lamps and 480-v ballasts in two rows the length of each section (above). After months of use 50 f-c is still delivered at the working plane. Combination beam clamps and hangers (right) support both fixture rods and conduit. Units are direct connected with three-conductor cord to 4-in. boxes. Below, 1,500-ma, extra high output fluorescent lamps in fixtures with upward component, 14 ft above the floor on 12x14-ft centers, light Thomas P. Hearne Corp. plant in San Diego to an average maintained level of 95 f-c at bench top level in the central area. For the 150x140-ft area 75 units were used



Prof. Dan Finch at spherical photometer in University of California laboratory

QUALITY—THE NEW FRONTIER

PROF. DAN M. FINCH, UNIVERSITY OF CALIFORNIA

Interior lighting today is in its most exciting stage of development. Lighting practice no longer consists exclusively of pouring the greatest amount of economically feasible light into an enclosure system for the interior environment.

Whereas in the past lighting criteria were based on one factor—illumination—present practice must take a comprehensive approach. The new system must strike a balance between the quantity, function and aesthetics of the lighting situation.

The evolution of interior lighting practice has shown a consistent trend toward broader concepts and the increasing importance of factors once thought to be the total responsibility of the architect and structural engineer. Office lighting is a typical example.

The first office lighting recommendations of the Illuminating Engineering Society, drawn up in 1917, specified lighting levels for various visual tasks; the more rigorous and exacting the task, the greater the illumination level. IES reasoned that a satisfactory illumination level—that is, a sufficient quantity of light—would result in optimum performance of the particular visual task.

This quantitative approach prevailed for many years. As the lighting art developed, it became possible to obtain a greater amount of illumination. The consequence was a periodic increase of the recommended illumination level through the years. Thus, the 1917 standards for ordinary office work were 4 to 8 f-c average illumination. By 1942 the figures were 30 to 50 f-c.

It has finally become obvious that increasing the foot-candles considerably beyond justifiable limits is not a satisfactory solution; often occupants of a highly lighted room prefer to have some of the lights in the room turned off. A new concept is needed. Interest has now centered on the quality of light.

Yet only a few designers have given thought to light quality. Some work on brightness relationships was done as early as 1908, and by 1930 there was a fairly large amount of research data available. But it was not until after World War II that brightness relationships and foot-lambert considerations came to be of major interest.

This first real recognition of the importance of light quality and the contribution of environmental factors opened the door. More and more emphasis is now being placed on the brightness aspects of the lighting scheme, and other expansive concepts have followed. The quality of light has become the new frontier for those concerned with interior illumination.

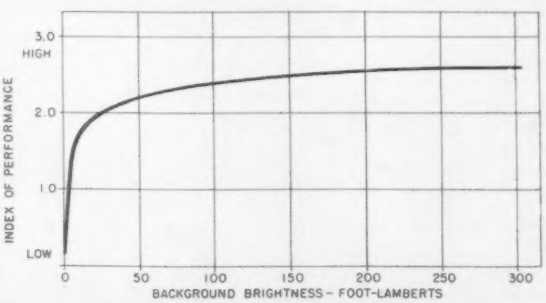


Fig. 1: Brightness and performance of a task

In Search of Quality

The technology of light production has reached the point where it is possible to have as much light as possible for any given visual task. The one remaining limitation is economy, and even it is not so stringent as in the past. Design latitudes are widely extended so that in an office interior, for instance, the light flux distribution can take an infinite number of configurations.

As shown in Fig. 1, performance does not vary linearly with the incident light upon the visual task. Note that the data are given in brightness units rather than foot-candles of incident light: To get 100 f-l may require 200 f-c or more.

A point of diminishing returns is reached at which a nominal increase in quantity will not produce a significant increase in performance. The lesson is clear: It is necessary to look to quality for improvements in seeing.

The concept of lighting quality goes well beyond the materials and workmanship of the actual hardware of the lighting units. It relates first to the general objective of the lighting system. The lighting designer must have a clear concept of the desired environment, whether it is to be the crisp and dynamic atmosphere of an office or the subdued luxurious-

A forthright article by a foremost researcher. It sets up basic considerations in application design. To give architects these same concepts, it was also published in our companion, Western Architect and Engineer

ness of an exclusive restaurant. Close inspection work required still another objective.

Next, the many special tasks of the lighting arrangments must be kept in mind. Within the typical office a multitude of tasks must be performed. Each will require individual lighting accommodations. The restaurant will have service areas demanding generous amounts of light, and perhaps points of special decorative interest that need highlighting. The desired effects of form and texture must be known beforehand—just as mood effects must be understood by the designer of stage lighting.

Another point to consider is whether an interior is to be used for the performance of specific tasks, or whether a mere transfer of general visual information is all that is required. Walking the length of a hallway, though sometimes tedious, cannot be considered a special visual task. The lighting need not reveal every crack in the wall and spot on the carpet; it need only make it obvious that one is in a hallway and show where there are steps or obstacles. Conversely, tasks such as clerical work and machine fabrication require prolonged visual concentration. Here improper lighting can cause eye fatigue and aggravate visual defects.

Given the design objectives, the designer must also know the means of accomplishing them. This requires recognition of the proper place for various forms of light sources.

Area sources, with almost complete uniformity, find application where the task to be performed requires movement about the entire interior, or where similar tasks are being performed throughout the work area. Line sources are useful in irregularly shaped areas where structural forms would interfere with a uniform system. They can provide guidance or area delineation. As supplemental units, they can bring the proper quantity of light to a critical area in such a way that glare is minimized and brightness ratios and color characteristics result in a high-performance visual scene. Point sources, with their special directional property, can be used in many of the same ways as line sources and for effective accent lighting as well. The inherent high brightness and nonuniformity of point sources are offset in proper application by advantages of flexibility and cost accruing from the great reduction in size.

How Do We See?

One fundamental factor often overlooked in lighting design is how things are seen. Attention to some of the phenomena of seeing would prevent many of the mistakes found in today's installations.

As an optical system, the eye takes the various patterns of brightness found in its field of view and forms a retinal image of them. By photographic standards, the image is poor. In the central foveal region of the eye the image is somewhat superior and color sensitivity is acute. Nature takes advantage of the small foveal region's sensitivity by not viewing in a stationary manner, but rather by scanning an irregular pattern. The result is not a chaotic swirl, it is the picture of the world which we see constantly.

The subjective result in the brain and the physical stimulus in the external field differ. Correct decisions in treatment of the lighting environment will only be made if the designer understands this difference.

An office file always looks like an office file, whether viewed in early morning, afternoon or twilight. Although the brightness stimulus may change a hundred-fold and physical color may change as well, the file does not change subjectively to one who knows he is viewing this particular file. One does not puzzle over the fact that according to physical measurements the file seems to acquire a different coat of paint as the hours pass. Subjectively, there is a constancy of color and brightness.

Similarly, if one views the file from a ladder and then from a point on the floor, the retinal brightness patterns will be completely different, but it's still the same file. There is a definite constancy of shape.

Looking at the handle of the file from across the room, it is the same handle as when seen at close view. The size of the image formed on the retina does not remain the same with distance, but many things about the room lead one to sense the true size of the handle. This is attributed to the close relationship between perception of object size and the perception of depth.

Investigation of this phenomenon of depth perception has brought many useful facts to light. When an object is viewed while one is moving, there is a change in position of the object with respect to other objects in front of and behind it. The slight variation in the amount of concealment of one object by another is unconsciously translated into the perception of depth. This visual clue is motion parallax; as the name implies, motion of either the observer or the observed is required.

Other binocular and monocular clues exist that are independent of motion. In binocular vision, since the eyes are slightly displaced from each other, two almost identical images result rather than one. This effect is felt up to a distance of approximately 100 ft. Called stationary parallax, it is similar to motion parallax in that the observer's mind translates it into the sensation of depth.

Of the depth clues requiring only monocular vision, the prime example is the convergence of lines. Convergence is quite marked in a narrow hallway, or when viewing a row of desks or windows. Again, concealment of objects by those closer to the observer contributes to the awareness of depth.

The effect of shadows is a related phenomenon. If one is aware of the location of the light source, then the shadow location and the shape of the shadow vary both with the position of the object and with distance. Shadows also give us information as to form and texture.

The Components of Quality

Returning to design objectives, the search for quality begins with the recognition that no two lighting problems are identical. Even assuming that the interior furnishings, structures and task requirements of two buildings are the same, they would have to occupy the same site to have identical illumination needs; surrounding terrain and structures can have a marked effect.

Moreover, within the general enclosure individual areas will be subdivided, either physically as modules or by the differences in tasks to be performed. The relative position of the people performing visual tasks to the furnishings and equipment they use should be determined, at least to an approximate degree. This may not be easy, and in some cases it simply cannot be done. But, wherever possible, the geometry of the lighting system should be integrated

"And if the system is to be stimulating over a sustained period of time, provision might well be made for allowing change in the configuration of color and brightness"

with the functional requirements of the enclosed space. It is quite improbable that a single system of lighting will suffice in an enclosure housing many diverse functions.

In addition to supplying proper illumination to each individual segment of the interior, all of the lighting must be interrelated to produce a pleasant and functional environment. It is easy to lose sight of the total atmosphere in attempting to satisfy each of the individual requirements. When dealing with critical work areas, distribution of the resulting brightness must be considered. A lighting design might be perfectly acceptable for one task yet distracting to another being performed nearby.

Spectral emission (color) of light sources also contributes to the atmosphere of an enclosed space. Color induces feelings of warmth or coolness, depending on its application. Besides setting a mood, it can enhance contrast and focus attention toward key areas. As with brightness patterns, color may be used either as a diversifier or as a unifying agent.

Color change can evoke alertness, and color uniformity can help produce relaxation. This fact has given rise to the suggestion that where it is desirable that the occupants of an enclosure be alert, lighting colors should be changed as the minutes and hours pass. The change of color would change the mood of the room, with a consequent improvement in attention to detail. Together with changes in color, changes in brightnesses have been subject of recent experimentation and the preliminary work shows great promise.

Light sources are far from the only contributors to the illuminated environment. All surfaces play their part. Every piece of furniture and equipment, every exposed portion of the building has its own characteristic reflectance properties. When light hits a surface, it will reflect in a diffuse, semidiffuse or specular manner. If the surface has luster or reflects like a mirror, glare can be produced, contrast of the object of concentration lessened, and an otherwise adequate system of illumination diminished.

Unfortunately, many machine tools and much office equipment fall within this category. Unless the surfaces can be changed, the lighting arrangement should be planned so that the reflected light will not cause glare; direct components of the light on the task should be incident from directions that will cast the reflected rays away from the person performing the task.

Directional reflective characteristics of materials can often be used to advantage if known in detail. In one study by the author, the visibility of reading material was being evaluated under various lighting systems producing the same total illumination on the task (30 f-c). Visibility was found to be directly related to the physical contrast, which was measured at 41% to 87% for the same task. For the worst condition, light sources were located in the area that produced specular reflection. For the best contrast, the lights were located to one side toward the rear of the observer.

A second consideration apart from light sources is the spectral characteristics (color) of all materials within the enclosure. It is essential that the spectral emission of the light sources and the spectral reflectances of the interior materials be compatible. The color of emitted light and the reflectance of the furnishings must supplement each other if the expected color of the enclosure is to be achieved. Many materials do not appear in their expected hues under certain fluorescent lights, producing disquieting atmospheres.

Spectral characteristics of interior materials can assist the lighting units in producing desired effects of continuity or movement. Work surfaces should be reasonably warm in tone, bearing in mind that this factor must not outweigh considerations of brightness. Points of attraction—work areas, centers of interest, places of relaxation—should be generally warmer than areas which would distract from the visual task, such as ceilings and most walls.

The desired effect, then, is to produce a pleasant and adequate environment for concentrating on the seeing tasks at hand. The combination of light sources and decor should produce warmth in the vicinity of the tasks. Illumination should be sufficient to produce easy performance of every task and should be concentrated on important areas, but it should not be completely uniform. Reflectances of all materials used should produce comfortable brightnesses without glare, and fixture location should assist in elimination of glare. Architectural forms should not produce unwanted shadow. And if the system is to be stimulating over a sustained period of time, provision might well be made for allowing change in the configuration of color and brightness.

Techniques of Lighting Design

How is all this to be achieved? As a start, the visual adaptation level should be selected for the known design objectives. The visual adaptation level is concerned with the eye's equilibrium when exposed to a visual field; after looking at a scene for a short time, every part of the retina reaches an equilibrium condition and may be said to be adapted to the field.

Here conflicting theories exist. One states that eye adaptation refers principally to foveal adaptation, since all of the critical seeing is done in the foveal region. A second theory rejects the idea that foveal adaptation predominates; the foveal region subtends a plane angle of only about 1.5°, it states, and the contribution of the remainder of the visual field is significant. The two points of view are illustrated by this example: If vision is concentrated on a dark circular area of 1.5° set against a very light background, Theory 1 would indicate a value approximately at the brightness level of the dark hole. Theory 2, which appears to the author to have more credence, would indicate a value approximately at the brightness level of the background.

In the absence of a standardized procedure, the average brightness in the field of view can be used. Applying this to various types of enclosures, a schoolroom or office should require an average adaptation brightness of 30 ± 10 f-l, an assembly area for small parts 60 ± 20 f-l and an exclusive restaurant perhaps only 5 ± 3 f-l.

Once the adaptation level is determined, design can proceed. Materials for the walls, the furniture and the appointments should be selected with these final brightnesses in mind. Surface texture, smoothness, luster and configuration are important factors that should be indicated on the specifications.

Specific visual tasks should be considered first. The primary lighting system should satisfy the needs of the principal function of the enclosure. A machine tool operator, for instance, should have the basic lighting necessary for the range of visual tasks normally encountered

in the performance of his job, which, in terms of quantity, may be in the order of 50 f-c of general diffused light. In addition, he probably will need 100 to 300 f-c of supplemental light at critical areas around his machine.

A general office area system should be designed to satisfy the needs encountered in paper handling and reading of materials with quite different degrees of contrast. This can probably be best accomplished by a semi-indirect system with good uniformity and about 15 to 30% of the light having a directional component. The average illumination level should be about 50 to 60 f-c to fulfill the basic seeing requirements. A quite different situation would be the lighting of a radar control room in an airport tower. Here there would be many highly specific problems to solve. The ideal solution would be to eliminate all sources of direct light on the radarscope faces to completely eliminate the possibility of glare and reflected images.

A basic design rule should be that the general brightness level be lower than that of the specific visual tasks. The average brightness within the principal field of views should not change radically when normal changes in viewing direction occur. As a first approximation, the principal field of view may be taken as a rectangle from 30° below the horizontal to 30° above and 60° to the left and right of the observer's line of sight.

If the brightness in the direction of the task is assigned a value of 100%, then a brightness range of about 30 to 200% may be tolerated between the task and its adjacent surroundings, provided that the size of the brightnesses above 100% are not extensive.

The maximum brightness of small sources within the field of view should be governed by the solid angle subtended at the eye and the location within the visual field. A small source in the field of view should not contribute more than one-tenth the total flux to the eye.

As all of this indicates, the lighting treatment of an enclosed environment is a complex process, in which the obvious and inobvious play equal roles. Close attention to the basic needs for a comfortable, pleasing and functional environment will help resolve many lighting problems. If, while you read this, you are dissatisfied with your immediate surroundings, there is much to indicate that the future will bring a favorable change.

Visibility—Comfort—Foot-Candles In Highway Lighting

PETER GARIPPA, LIGHTING SPECIALIST, GENERAL ELECTRIC CO.

- Now, ratings for roadway lighting can be based on seeing benefits.
- Correlation of night traffic ratings with relative visibility and relative visual comfort ratings will indicate how good the lighting must be for the public benefit.
- Attention could be given to the conversion of present roadway lighting stands from *foot-candles* to *foot-lamberts* as an intermediate step.
- Consideration should be given to the use of recently developed instruments with the objective of eventually establishing ratings for *comfort and visability*.

It has long been a desirable goal of lighting engineers to be able to evaluate quantitatively the over-all visibility and comfort of a roadway lighting installation. Establishment of seeing factor ratings would enable the prediction of the effectiveness of roadway lighting in readily understandable terms of user benefit derived. This is of great interest to those who decide how much roadway lighting will be installed.

Wilbur Smith, consulting engineer, says, "Better means of objectively measuring highway lighting systems would probably be one of the most effective means of encouraging and justifying the more widespread use of highway lighting on expressways and other major highway facilities."

Inadequacy of Foot-Candles

Until now, quantitative evaluation of roadway lighting has been limited largely to only one of the factors involved, namely, foot-candles. The inadequacy of foot-candles alone has been stated very nicely by R. E. Ballard, engineer for Connecticut Light & Power Co., who says: "The use of foot-candles as a measure of the quality of illumination has long been recognized as a ridiculously outmoded crutch. Roadway lighting is intended to produce comfortable optimum visibility and there is not necessarily any relationship between foot-candles and visibility as such."

European Practice

European practice, already ahead of American practice, makes recommendations on street lighting in terms of foot-lamberts, not foot-candles. Foot-lamberts are more nearly related to actual visibility as the eye sees brightness, not quantity of light. In the Netherlands, the recommended minimum value of road surface brightness on highways is 0.6 f-l and the highest permissible irregularity in the brightness pattern, expressed as the ratio of the maximum to the minimum brightness on any line across the road, is three to one. The objective is to achieve effective lighting installations by combining adequate pavement brightness with a minimum of glare.

Ratings for Evaluation

Ratings to be used for evaluation of the visual seeing effectiveness of roadway lighting systems may be one of the following types.

1. Computed rating method
2. Outdoor laboratory evaluation

The Computed Rating Method provides a method of rating roadway lighting systems in terms of seeing factors. Ratings for existing or proposed systems may be computed by considering the composite effect of the various factors involved, such as pavement brightness, obstacle brightness, field brightness, brightness fluctuation and glare. The end result is a dual rating of both visibility and comfort.

The Outdoor Laboratory Evaluation Method is based on instrumentation recently developed for field measurement of seeing factors. In the United States there have been developed:

Prichard brightness meter

Fry-Prichard meter for disability veiling brightness (glare)

Blackwell-Prichard visual task evaluator

Finch visibility meter

Guth evaluator—rates the relative visual comfort of roadway lighting

U. S. Bureau of Public Roads Instrumentation for operations and driver response

With the adoption of these standards and techniques, the lighting engineer can then scientifically specify lighting in terms of the ultimate benefit to the man behind the wheel.

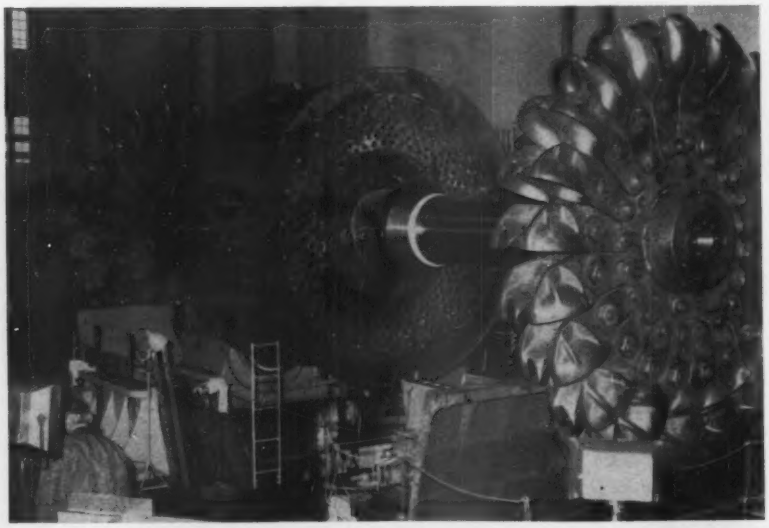
ULTRASONICS—New Tool for Utilitymen

Three ways in which this new technique can be used to advantage in maintenance operations

I—Hydro Unit Shaft Inspections

L. W. WOOD, CENTRAL SUBSTATION DIVISION SUPERINTENDENT, SOUTHERN CALIFORNIA EDISON CO.

P. B. DAWSON JR., PELTON DIVISION, BALDWIN-LIMA-HAMILTON CORP.



Ultrasonic inspection of water wheel generator shafts has proved to be a very valuable tool in our preventive maintenance program covering hydro plant equipment. The recent detection of a flaw in the shaft of No. 2 unit, Big Creek No. 2-2A, typifies the value of this type of nondestructive testing. This double overhung impulse type unit is rated 68,000 hp.

Unit 2, at the Southern California Edison Co.'s Big Creek 2A plant, was placed in service in 1928. Its original rating was 56,000 hp at 250 rpm. In 1949 it was converted to 60-cycle operation at 300 rpm and uprated to 68,000 hp. The shaft stresses were

Rotor and waterwheel assembly of Big Creek No. 2-2A being lifted from its bearings to the generator floor to be dismantled

Opposite: During manufacture of new shaft, Unit 2 at Big Creek No. 2-2A was inspected frequently to determine that unit could be operated safely at reduced output. Top right: Shaft from Unit 2 following removal—note coolant pipes at right. Center: 400-ton hydraulic jack used to disengage old shaft from generator rotor of Unit 2. Bottom: Right-hand bearing assembly after installation of new shaft

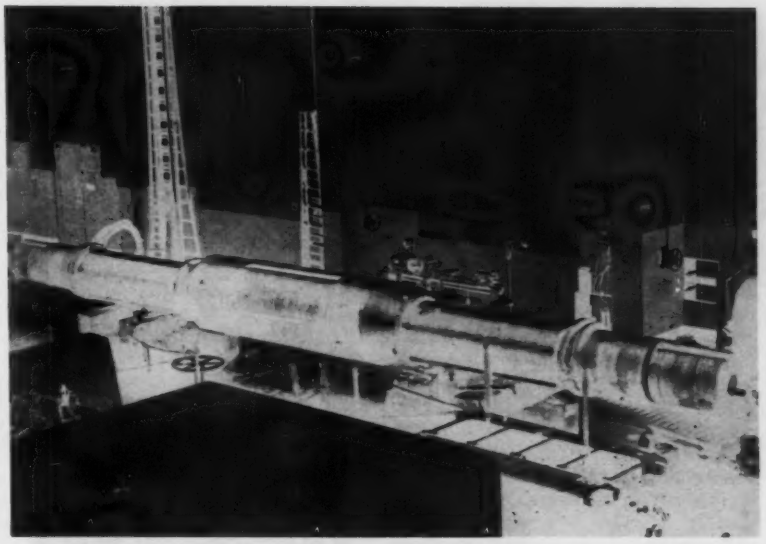
noted to be high from the standpoint of alternating stresses and a program of regular periodic inspection was recommended.

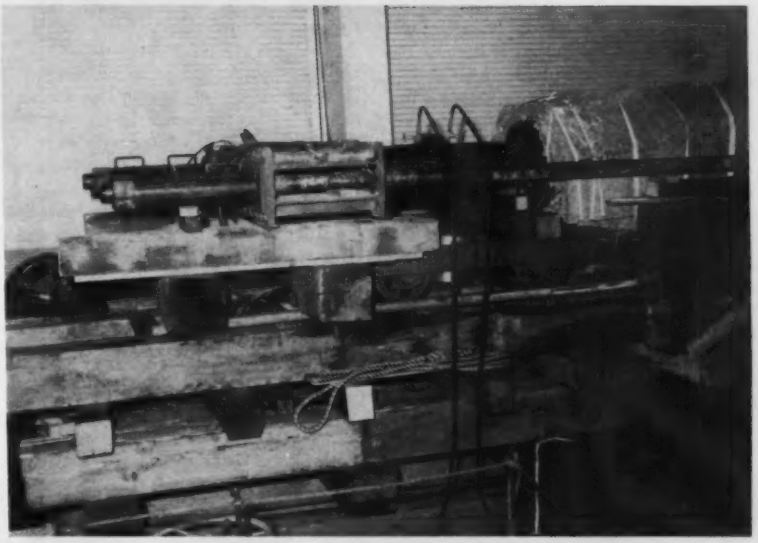
Starting in 1951, periodic ultrasonic inspections were made on the shaft of this unit. The initial inspection showed many small, well dispersed inclusions, but nothing that was considered detrimental to operation at full output. When the shaft was inspected in November 1956, a flaw was detected in the 26 in. diameter right hand journal approximately 6 in. below the surface. From reflectoscope findings, the flaw was analyzed to be about 2x6 in., with the 6-in. dimension parallel to the longitudinal axis of the shaft. The area formed a cylindrical plane concentric with the shaft.

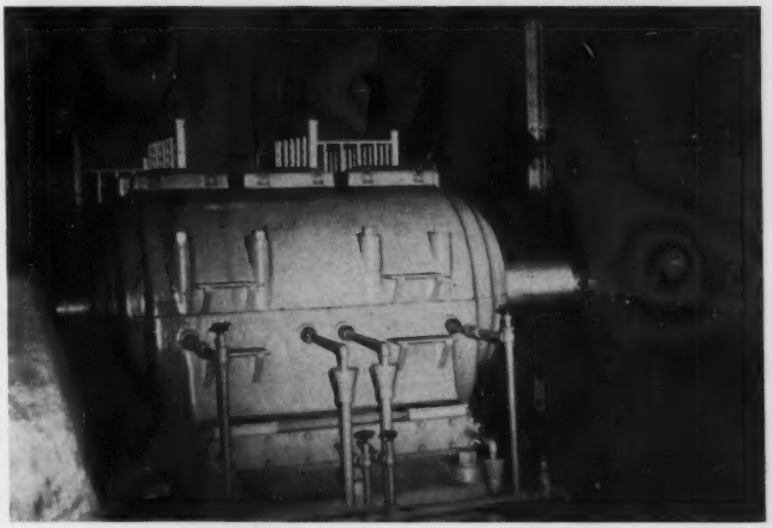
After completing the analysis of the indicated flaw, it was decided to replace the shaft with one of nickel alloy steel, 28 in. in diameter at the journal. During the time required to obtain a new shaft, load was limited to a fairly small output and frequent reflectoscope inspections were made to be certain of continued safe operation. During manufacture of the new shaft, reflectoscope inspections at the various stages showed the foregoing to be of excellent quality and inspection of the journals after a short period of operation revealed no inclusions of any consequence.

Following removal of the old shaft, a section of the right hand journal was cut out and the metal sliced into wafers in the flaw area by Pelton Water Wheel Co. to verify the reflectoscope findings. Prior to cutting the shaft, soniscope testing equipment was unsuccessfully used in an attempt to detect the flaw. It was determined that soniscope apparatus is not suitable for detecting small flaws in steel shafts because of the density and shape of the material being tested and inability to accurately measure small fractions of a microsecond.

The ultrasonic indication, however, proved to be caused by a flaw which, based on good metallurgical advice, was a hazard that could have led to shaft failure. Thus, ultrasonic inspection proved to be a valuable tool for preventive maintenance.







II—Boiler Tube Inspection

M. A. BALKE, EFFICIENCY ENGINEER, AND T. G. CASEBOLT, CHEMIST, PACIFIC GAS AND ELECTRIC CO.

Ultrasonic methods of boiler tube inspection provide a means of determining the presence of incipient corrosion by measuring the metal loss in the tubes resulting from chemical action brought about by the deposition of iron and copper on the internal surfaces of the tubes. With good chemical control there are usually only one or two vulnerable locations in the boiler circuitry where tube failures are likely to occur. Thus ultrasonic inspections can be confined to rather limited areas with good assurance of locating any incipient trouble which may be developing.

While there are many methods of nondestructive testing to determine incipient faults, such as X-ray, gamma ray radiography, fluoroscopy, magnetic particle, black light, eddy current and ultrasonics, only the latter two have characteristics particularly adaptable to boiler tube testing. The other methods require either a film or some source of illumination on the opposite side of the material being examined or are limited to the location of surface or near surface flaws. **The ultrasonic and eddy current methods require access only to one exposed surface and this surface, in boiler tube testing, is the all-important fireside of the waterwall tube.**

The ultrasonic methods used in tube testing employ either the "pulse echo" or "resonance" methods. These two methods are similar since they are composed of a sound transmitting device, a receiver, an amplifier system for the received signals and some means of presenting the amplified signal.

Both systems use piezoelectric crystals excited by high frequency oscillators. The vibration of the crystal due to rapid polarity changes of the applied alternating current sends out sound waves of a frequency normally between .25 and 25 mc per second, depending on the crystal thickness and the frequency of the exciting current. The sound waves are subsequently transmitted to the test sample through a fluid couplant, such as oil, grease, water or any liquid or semiliquid. The same crystal, since it possesses the ability to convert sound vibrations back into electric impulses, serves as the received signal transmitter.

In the pulse echo method the crystal transmits for an interval of time, then becomes silent to await the return of reflections of the transmitted sound waves. The transmitting and receiving cycle is repeated at a rate of about 100 to 500 times per second. The first reflections occur when the sound waves reach the outer surface of the tube. This front surface will reflect approximately 80% of the sound energy back toward the crystal which converts into electric current that is amplified and visually displayed on the left-hand side of a cathode ray tube in the form of a trace or pip. If no interference, in the form of a hidden flaw, is encountered, the remaining 20% of the sound energy will continue on through the specimen until the inner surface of the tube is reached. Again the sound energy is partially reflected and appears as a second pip farther to the right on the cathode ray tube. **Interference in the form of a break or hidden flaw will show up as a third pip at some point between the front and back surface pips.**

On the cathode ray tube, the horizontal sweep represents increased time from left to right. Thus the pips are spaced along the horizontal sweep according to their time of receipt. The distance between pips is proportional to the elapsed time and hence can be considered as an indication of metal thickness.

In the resonance method, the transmission of the crystal is continuous but varied in frequency. Since any piece of material has a point of natural resonant frequency to sound waves transmitted in the direction of its thickness, the continually varying frequencies of the ultrasonic waves will at some given moment equal the resonant frequency (or an even multiple or harmonic of that frequency). The crystal will react to this in-phase period as the accompanying increased amplitude of the vibrations within the material is received by the crystal, resulting in an increase in the current produced by the piezoelectric crystal and consequently a pip will appear on the scope. **The pip or pips across the face of the tube may be translated directly into thickness by superimposing a transparent calibrated scale on the tube face.**

Experience has shown that the pulse echo method lends itself more readily to the rapid scanning of large areas because the pulse echo dolly can traverse the length of a tube in a relatively short time without damage to the crystal, since it is separated from the abrasive tube surface by a water film. In the resonance method, the crystal contacts the tube with only a slight film of lubrication between, thereby causing the operator to proceed cautiously to avoid damaging the crystal. Likewise, minor surface irregularities are more critical with the latter method.

Gamma ray radiography was also tried in two instances. To obtain data by this method, pictures were taken by placing a film holder in contact with the waterwall tubes on the inside of the firebox and then suspending a cesium 137 isotope in the respective areas outside the firebox. Exposure time for each picture was about 14 to 40 minutes depending on the thickness of the insulation, etc.

Interpretation of the photographic negative made by this method could be made only on the basis of lightness and darkness of the exposed film. In comparison with the pulse echo system, results appear to be less definitive and relatively high in cost. Generally there are a number of areas in the boiler that are inaccessible for this method of testing.

Thus far, approximately 47,000 lin ft of boiler tubing have been subjected to ultrasonic inspection and the results have been very reliable, although not entirely infallible. **However, no failure has been experienced in any area shown to be in good condition by the ultrasonic inspection.**

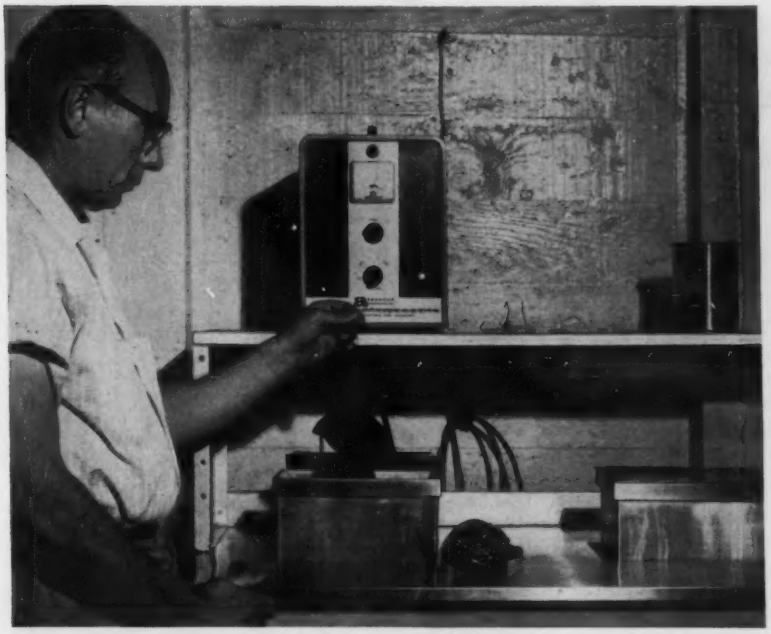
An underwriter says . . .

The ultrasonic testing of steam boiler water walls, heavy machinery shafting and journals and of unfired pressure vessels (i.e., pulp digesters, paper machine dryer rolls) has disclosed dangerous conditions which, if left undetected, could have caused property losses exceeding $1,000,000 with ensuing loss of life and serious injuries.

The engineering division of the Travelers Insurance Co. believes ultrasonic testing is an important addition to nondestructive test methods. A number of our nation-wide staff of 520 inspectors makes use of this new method for loss prevention work and in the underwriting of boiler and machinery equipment.— ***A. Robbins Whittlesey, Pacific Coast Manager, Boiler and Machinery Division, The Travelers Insurance Co.***

III—Cleaning Demand Meter Registers

EARL R. STIMPSON, METER FOREMAN, P. G. AND E.



The cleaning and repair of demand meter registers and timing devices, in general, has long been a problem of considerable magnitude for most utilities. Consequently many metermen looked with real interest on the possibilities of ultrasonic cleaning methods, which have been used so successfully in the aircraft engine and similar industries.

Action was taken by the San Joaquin Division of Pacific Gas and Electric Co. in 1958 when, after much investigation, an ultrasonic generator and one tank were purchased. A few months of experience demonstrated that additional time could be saved if a second tank were available, the generator being of a type that would permit operation of the two tanks simultaneously.

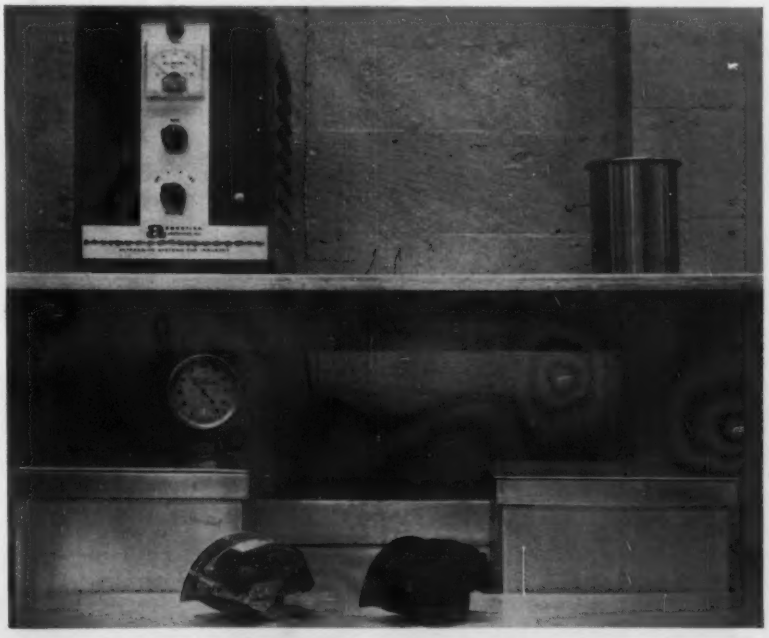
In this relatively new field there was little experience to draw on and consequently considerable experimentation with regard to the proper type of solutions had to be undertaken.

Of all the solutions tried only three seem to be of real value. The L & R No Foam cleaning solution does an excellent job on any register except that it caused serious reduction in clutch friction on one style of demand register, which necessitated removal of the clutch shaft from the register before cleaning. This operation defeated the time-saving purpose of the ultrasonic equipment.

After further experimentation, a solvent called No. 25-I obtainable from Pioneer Central, a division of Bendix Aviation, proved to be satisfactory. Excellent cleaning of every part of the register resulted and the effect on the clutch was negligible. In using the 25-I solution, it must be heated to about 160 to 170°. This temperature is maintained by a small home-made immersion heater that provides enough heat input to offset radiation from the tank. After treating the registers in the ultrasonic bath, they are rinsed in hot water and then subjected to a second rinse in trichlorethylene. They are then blown dry with compressed air.

Objects that are soiled with grease or oil can best be cleaned in the L & R No Foam solution, which does not have to be heated. Parts that are soiled with a carbon deposit, such as might be experienced from internal explosions, can be well cleaned in a hot solution of Oakite No. 33. These three solutions, L & R No Foam, Oakite No. 33 and 25-I, provide truly astonishing cleaning results in combination with the ultrasonic bath.

Although the major part of the experimentation has been on the cleaning of combination registers, watt-hour meter registers have been cleaned whenever necessary. With the ultrasonic method, a watt-hour meter register that formerly required from 8 to 10 minutes to clean is now cleaned better in considerably less than two minutes. Demand registers are likewise cleaned better in two to three minutes in contrast to the 16 to 20 minutes required by previous methods.



Ultrasonic equipment used by San Joaquin Division, PG and E, for cleaning meters. At right: Meters before and after cleaning

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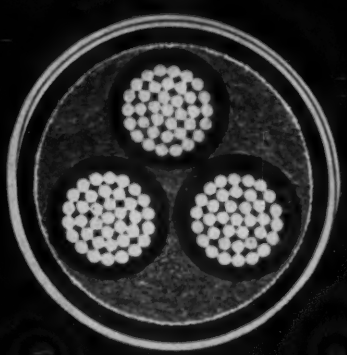

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600	5:1	0.3	0.3

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Every advantage of butyl-molded construction is now available in a 600-volt potential transformer for indoor or outdoor use. Lighter, smaller and less costly than other units—General Electric's new JVP-O is designed for high accuracy on single and multiple meter applications.

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People

PG and E Changes in East Bay

Howard H. Jackson, division power plant superintendent for Pacific Gas and Electric Co.'s East Bay Division, was promoted to the new post of division power generation manager in a reorganization of the company's East Bay steam-electric generating system.

N. E. "Dusty" Rhodes was named to assist him with the title of division superintendent of power production. E. F. Kaprielian, senior engineer in the company's main office, department of steam generation, succeeds Rhodes as superintendent of San Francisco Division's steam plants. The company's East Bay Division has seven steam plants, employing 500 persons. When a large addition at Pittsburg goes into service, it will be capable of generating 1,860,000 kw, more than half of the company's steam-electric capacity.

Trapped Men Rescued

Nine British Columbia Electric Co. men worked with men from Hume & Rumble, electrical contracting firm, and others to rescue nine workers trapped by 30 ft of rock in the Lillooet district, not far from B. C. Electric's Bridge River power plants.

The cave-in at the Gold Contact Mine occurred at about 11 a.m., trapping Pat and Percy McDonald for 30 hours. B. C. Electric crew arrived at the scene at about 1:30 p.m. and immediately went into action, shoring up the tunnel mouth and clearing away the debris to give the rescuers ample room to move.

After rescue teams arrived from Bralorne Mine, the B. C. Electric crew continued to help where needed, packing in supplies, tools and food, cutting timbers and helping to push the mine cars out of the tunnel as they were filled by tunnelers at the face of the fall. The utility crew, which is constructing bridges and a maintenance road on the power transmission line, got word of the accident from the son of one of the trapped miners.

► **Lyman B. Goodge,** with Westinghouse at San Lorenzo, Calif., received an award for 40 years of service at a luncheon hosted by Joseph C. Belloni, Pacific Coast regional manager of distribution services. Presentation was made by Vice-president Walter J. Maytham. Goodge started his Westinghouse service at Seattle in 1920 and was in Ogden, Utah, for two years before moving to San Lorenzo.

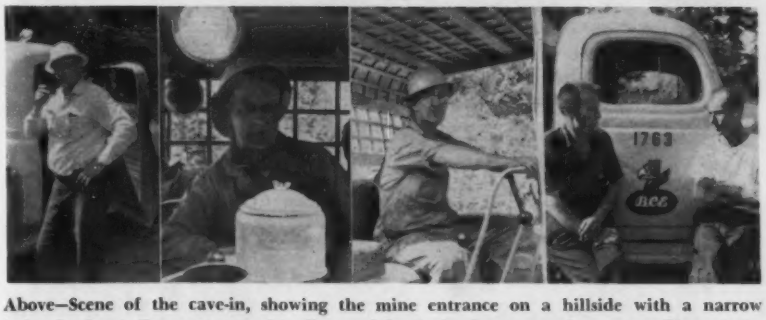
► **Col. Gordon B. Page,** U. S. Army Corps of Engineers, has been appointed assistant director for Army reactors, Division of Reactor Development. Colonel Page also will serve as special assistant for nuclear power, Office of the Chief of Engineers, U. S. Army.

► **Shirley K. Brown** retired Aug. 1 as purchasing and stores supervisor for Tacoma's Department of Public Utilities, after nearly 30 years of service. He had been supervisor since 1955.

► **George A. Work,** former Los Alamos physicist, has been appointed chief project engineer for Leach Corp.'s Special Products Division.

50-Year Award

John Boyle, vice-president and general manager of California Oregon Power Co., received an engraved wristwatch to commemorate his 50th anniversary with the company and its predecessors. A. R. Leavitt, personnel director, made the presentation for company employees. H. P. Bosworth, vice-president and assistant to the general manager, stands at left



Above—Scene of the cave-in, showing the mine entrance on a hillside with a narrow ledge in front. Rescuers were handicapped by lack of maneuvering space. Five of the rescuers, left to right—Ray Street, T&D maintenance supervisor; Bill Dodds and Alec Johnston, tractor operators; Jim Murray and Joe West, miner-powder men

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► **Robert B. Macrae** has been sent to Hawaii as vice-president of Air Conditioning Co., distributor for Carrier Corp.

► C. P. Clare & Co. has appointed **Murray H. Corwin** as sales engineer in its Los Angeles office.

► **William Searls,** formerly southern Los Angeles sales representative for International Rectifier Corp., has been made field sales representative in the southern California sales region, according to **W. H. Atkinson,** marketing manager. With offices in El Segundo, Calif., he will service customers in Orange County, Pomona, Riverside and San Diego areas.

Searls

► **Delbert B. Hutto,** with AEC's Grand Junction, Colo., operations, has received a sustained superior performance award and a check for $250 in recognition of outstanding service. His present position is chief of the accounts payable section, Finance Division, and the award recognized "the outstanding manner in which he has performed his duties during the past seven years."

► **William E. Heidorn** has joined Fischbach & Moore, electrical contractors, as senior estimator in the Western regional headquarters at Los Angeles. **Jack Miles** was appointed to an electrical estimator's position in the same office.

► **Don Glass** has joined Western Lighting Corp. of Los Angeles as sales engineer, according to Milton Weiner, sales manager. Glass was formerly associated with Graybar and with another lighting manufacturer.

► **W. H. Diederichsen** was elected secretary of the permanent California State Conference on Apprenticeship at its recent meeting in San Francisco. The State Conference embraces all of the craft's apprenticeship committees. Diederichsen is business manager of Local 617, IBEW, San Mateo.

► **Fred G. Kirchubel,** formerly of San Francisco Lighting & Supply, has joined the staff of Incandescent Supply Co. in Sacramento. He has spent many years in the Sacramento area.

► **Neil J. Mahar,** project builder representative for Washington Water Power Co. at Spokane, has retired after a 26-year career with the utility. He joined the sales department of the firm in 1934 and has held his present post for the past five years. Active in home builder affairs in Spokane, he has served as chairman of the annual Parade of Homes promotion of the Home Builders Assn. of Spokane.

► **Beverly D. Kumpfer,** general manager of the Salt Lake plant of Litton Industries Inc., has been awarded the Electronic Achjevement Award for 1960 by the Salt Lake Section, IRE. The award is for his contributions to the microwave tube art through design and production of magnetrons for military and commercial application.

► Bailey Meter Co. has announced appointment of **A. L. Danielsen** as sales manager for Region IV, comprising its Western sales district offices. His headquarters will remain in Denver, where he has been district manager. Joining the company in 1940, he worked in the Chicago district before moving to Denver.

Danielsen

► **Ralph Henna,** customer service representative in Beaverton for PG and E, has taken over residential sales activities in that city.

► **Dorothy G. Krueger,** typist-clerk for the Electrical Division of the city of Portland, won first prize and a two weeks' trip for her mother and herself to Hawaii from Imperial Electric Heat in an essay contest on the values of electric heating.

► **Edward J. Guelpa** has been made general manager of the Western Division of Taylor Fibre Co., La Verne, Calif., replacing **Milton F. Chapel,** resigned. Guelpa had been district sales manager for the Western Division since July 1959.

► **Wilbur Phillips** has joined the staff of William Hagen, manager of Zinsco Electrical Products Sacramento office.

► **Gene McLennan** has been named Quicfrez manager for the northern half of California and half of Nevada. His headquarters are in Santa Clara, Calif.

► **Jack Beckett,** who left Wesix recently to go with Hewlett-Packard Co., has been made general manager and chief engineer of its subsidiary, Palo Alto Engineering Co.

► **Lyman J. Harris** has been made Vancouver Operations' chief engineer in reorganization of Aluminum Co. of America's engineering departments. He continues as Alcoa's Northwest power manager. Succeeding him as chief electrical engineer at the Vancouver plant is **Paul H. Kimmel,** previously chief engineer at the company's East St. Louis, Ill., works.

Harris

► **Paul D. Cline** has been named plant manager for Swan Mfg. Co., electric heat unit manufacturer at Vancouver, Wash.

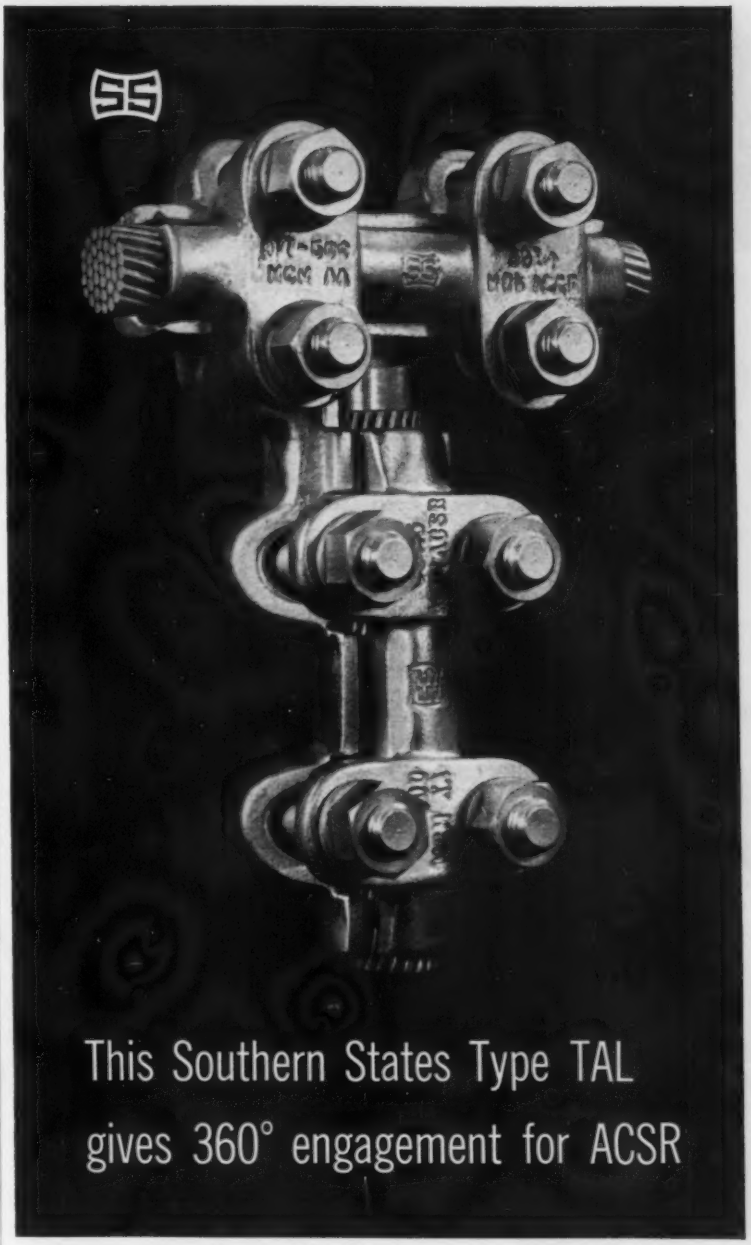
► **H. T. Brazil** has replaced **Don Gardiner** as chief engineer for the Okanogan County PUD. Gardiner has joined the Snohomish County PUD at Everett. Brazil at one time was civil engineer for Line Material Co. in Butte.

► **Lucile Lomen,** former attorney at G-E's Atomic Power Equipment Department in San Jose, Calif., has been named to the top legal post at G-E's Aircraft Nuclear Propulsion Department. She replaces **Clayton Crandall,** who has been made counsel at the company's Hanford Atomic Products Operation in Richland, Wash.

► **Fred B. Hornby,** formerly at G-E's San Jose plant, has been made manager of the Rome branch of International G-E Operations S. A. While at San Jose he was responsible for design and start-up of West Germany's first power station reactor. He also was project manager for design and construction of G-E's Vallecitos test reactor at Pleasanton, Calif.

► **Raymond Eisbrener,** Sacramento manufacturers' representative, has been named regional sales manager for Emerson Pryne Co.

► **Bob Christensen** has been made Northwest regional manager for Byron Jackson Pumps, replacing **Harlan Thompson,** recently transferred to New York. Christensen's territory extends from Fresno, Calif., to the Canadian border.



The unique design features of this connector reflect the engineering behind the entire Southern States line of fittings. For instance, to assure good electrical and mechanical characteristics, it provides independent clamping on run and tap conductors; its maximum contact engagement minimizes conductor clamping stresses; and conductor-fitting grooves limit cable distortion.

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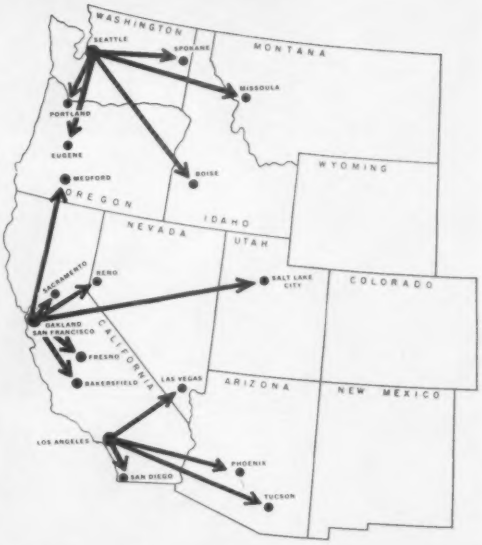

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► **V. M. Murray,** Seattle area manager for Bonneville Power Administration, retired after 20 years of service. **Robert M. Hollans,** operations and maintenance supervisor for the area, has been named acting manager. He moved to Seattle in 1947 following terms as Yakima and Walla Walla district manager. Murray received the Department of Interior's Gold Medal for contribution to the utility field in 1959. According to BPA Administrator William Pearl, many of his original innovations are now standard procedure in the electrical industry.

► **A. V. K. Babcock,** area development manager for Arizona Public Service Co., will be one of three businessmen composing the first United States Trade Mission to Afghanistan and Iran from Aug. 20 through Oct. 8.

► **Harold F. Harms** has rejoined B. C. Electric Co. as farm representative at Abbotsford. With the company from 1945 to 1958, he has since been in private business.

► San Diego Gas & Electric Co. has appointed **E. C. Saunders** to the newly created post of customer accounting manager. **R. R. Connors** will succeed him as data processing supervisor. **C. D. Stewart** is tabulating supervisor and **George Couvrette** is acting paymaster until Oct. 1, when he becomes paymaster, succeeding **W. P. Burkhardt,** who is retiring.

► **Walter G. Schulz,** chief of the California State Department of Water Resources' Division of Design and Construction, has resigned effective Nov. 15. He will join the engineering consulting firm of Leeds, Hill & Jewett Inc. of Los Angeles as vice-president in charge of a new San Francisco office. He had an important part in designing features of the proposed California state water plan, including Oroville Dam.

► **Margaret Sullivan** was made assistant secretary of Montana Power Co. in what is believed to be the first appointment of a Montana woman to an executive post in a major corporation. She has been with Montana Power Co. since 1931 and since 1934 has been secretary to President John E. Corette.

► **Dr. Oscar Buneman** of Cambridge University has joined the Stanford Electronics Laboratories as senior research associate and lecturer in electrical engineering.

► **William D. Ross** is another National Electrical Products man who has gone over to represent the new conduit company, headed by other former members of the same company. He joins W. B. Imholt Co., San Francisco, after many years in the industry as a sales representative on the Wheatland Electric Products Co. line of conduit, underfloor duct, etc.

► **Floyd McNeil** has joined the electrical staff of Fiberboard Paper Products, San Joaquin Division, at Antioch. He was formerly with Western Canners Inc., and is the chairman of the Contra Costa Chapter of the EMEA of California.

Alaska Co-ops Report Changes

Mason LaZalle has been named manager of the Matanuska Electric Assn. in Palmer, Alaska. LaZalle worked with the Chugach and Anchorage electric systems before going to Matanusak in 1958.

C. A. Brewer is now manager of Copper Valley Electric Assn. at Glenallen. He had been manager at Matanuska Electric Assn.

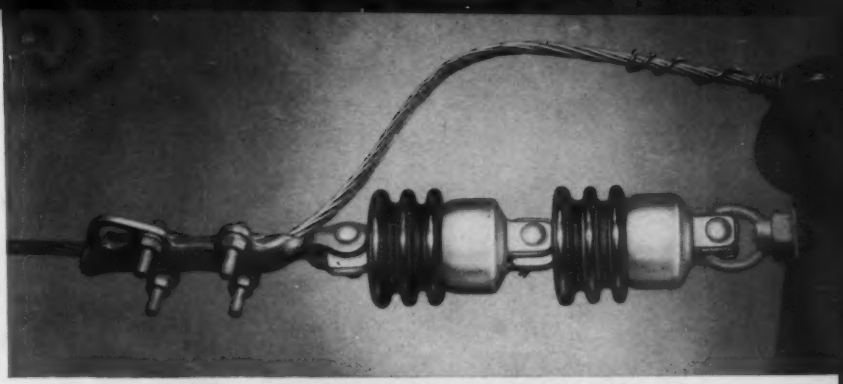
Erling H. Orwoll was named manager of the Chugach Electric Assn., Anchorage, succeeding Clyde M. Ardin. Orwoll joined the staff in August 1957 and had been serving as operations analyst.

Clyde Ardin has been appointed power engineer and advisor to the Kingdom of Laos. Ardin's resignation as manager of Chugach Electric Assn. was effective April 15.

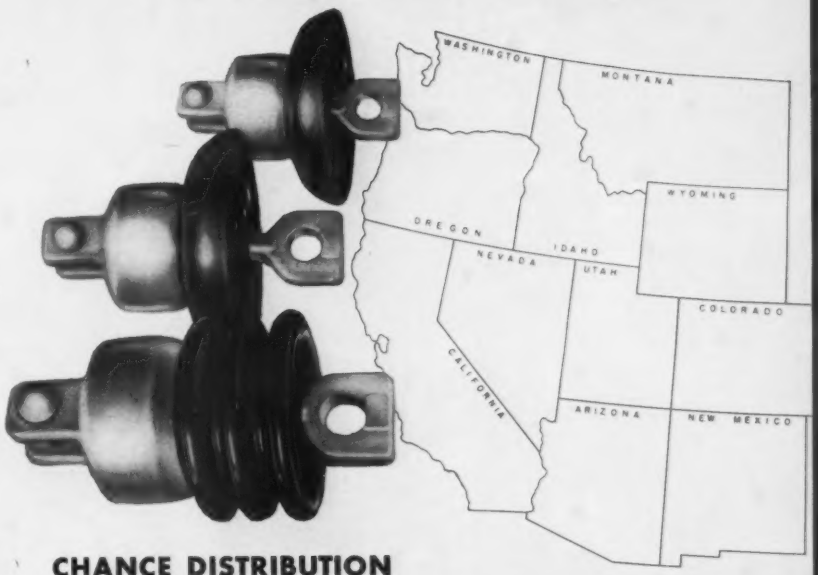
► **Robert W. Blodgett,** former office manager for the Big Bend Electric Cooperative at Ritzville, Wash., has been named chief accountant for the Benton County Public Utility District at Kennewick, Wash.

► **Robert C. Harper** has joined the wholesale and merchandise division of American Factors Ltd. as administrative assistant to W. L. Doering, vice-president and general manager. Harper was vice-president of Sylvania Electric Products Inc., lighting division, for the Western area, San Francisco.

► **Dr. Miles C. Leverett,** manager of the development laboratories for G-E's Aircraft Nuclear Propulsion Department, is the president of the American Nuclear Society for 1960-61. A pioneer in the atomic field, Dr. Leverett was one of several engineers who worked with Dr. Enrico Fermi when he built the world's first nuclear reactor.



NEW PRODUCTS TO SERVE THE FAST GROWING WEST

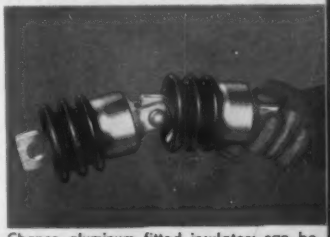


CHANCE DISTRIBUTION DEADEND INSULATORS WITH CORROSION-RESISTANT ALUMINUM FITTINGS

Here's the new look in distribution deadend insulators . . . Chance Insulators with aluminum caps and studs. The first insulators with corrosion-resistant all-aluminum hardware that makes them as much as 30% lighter than standard insulators and ideal for all types of distribution deadend installations. Because they are lighter, they're easier to install. And, because the aluminum hardware is highly resistant to corrosion, they have a longer service life.

The new 4½ inch SLIM-LITE design (foreground) has a higher mechanical impact rating and a puncture voltage rating 35% higher than standard 6 inch discs. Its slim contour improves appearance of lines and makes it easier to cover with protective equipment.

500 hour salt fog tests had little effect on aluminum cap (left), while ferrous cap (right) is badly corroded and damaged after the same amount of exposure.



Chance aluminum fitted insulators can be handled easily without breaking because the square tongue keeps porcelain apart.

ABC INDUSTRIES

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(A. B. Chance Company of Canada, Ltd., Toronto)

C160-27

20 years beneath the sidewalks of New York
USS Tiger Brand Paper-Lead Cable

Like most utilities, Consolidated Edison of New York City, is engaged in an endless race to keep up with the growing demand for electric power.

In the Williamsburg section of Brooklyn, new USS Tiger Brand Paper-Lead Cables were installed to replace some of the existing ones that were being removed, due to system rearrangement, after 20 years or more of service. In some areas, the new cables were an addition rather than a replacement. The old cables were still giving good service but additional capacity was needed.

USS Tiger Brand paper-insulated, lead-sheath cables are noted for their reliability. More than 56,000 feet were used by Consolidated Edison in recent expansion programs. Engineering specifications called for 2/0, 27 KV, 3-conductor cable in carefully predetermined lengths for the Williamsburg section.

For high-voltage feeders, USS Tiger Brand Paper Insulated Cable is available in solid or gas-filled types. Many special constructions are available as standard production. An inquiry detailing your requirements will receive our prompt and careful attention. Write American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks

Power boost for Williamsburg area. Crew makes a 383-foot pull applying lubrication on the new Tiger Brand Cable as it is fed into the underground duct.

USS Tiger Brand Electrical Wire & Cable —A standard cable for every special job

Asbestos Wire and Cable • Varnished Cambric Cable • Mold-Cured Portable Cord • Interlocked Armor Cable • Shovel & Dredge Cable • Special Purpose Wire & Cable • Paper & Lead Cable • Aerial, Underground and Submarine Cable

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

PVC ROYALOK

Caps and Connectors interlock with a twist of the wrist . . . give you rugged, positive, fail-proof power connections.

Unbreakable molded vinyl bodies—can't crack, chip, or break . . . hold blades and contacts solidly in place. Resistant to acid, oil, and grease.

Safer, stronger construction— Dead-front caps eliminate nuisance of fiber washers and dangers of exposed conductors. Internal barriers separate conductors. One-piece connectors have heavy brass double-wipe contacts locked in solid vinyl.

ORDER FROM YOUR WHOLESALER, OR WRITE FOR CATALOG 2-58-4.

QUICK, CLEAN WIRING
3 Simple Steps!

1. Remove cord grip plate by loosening plate screws (they can't fall out).
2. Insert cord thru clamp, strip conductors and connect to terminals.
3. Replace grip plate, tighten screws — that's all!

A Broad Line of ROYALOK Interlocking* Devices

2-Wire Polarized	3-Wire Polarized Grounded	4-Wire Grounded
10 Amp — 250V 15 Amp — 125V 20 Amp — 250V Dead-front caps . . . one-piece connectors	10 Amp — 250V 15 Amp — 125V 20 Amp — 250V 10 Amp — 600V Dead-front caps . . . one-piece connectors	20 Amp — 250V 10 Amp — 600V Dead-front caps . . one-piece connectors

*Fit all standard interlocking devices

ROYAL ELECTRIC

...an associate of

ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND
SALES REPRESENTATIVES AND WAREHOUSES: Los Angeles—1950 Naomi Avenue, RI 7-9655; **San Francisco**—1225 Sixth St., HE 1-5792; **Seattle**—4130 First Ave., So., MA 3-8882; **Denver**—888 S. Lipan Street, WE 6-3456

► **Maj. Lawrence L. Heimerl** is the new executive officer of the Walla Walla District Office, Corps of Engineers. He previously served as a member of overseas assignments and with the Eastern Ocean District at Labrador.

► Elevated to the grade of Fellow in AIEE: **Hilding F. Gidlund,** superintendent of the Electrical Distribution Department, Public Service Co. of Colorado. He was honored for contributions to development and operation of a large electric distribution system.

► **Jeff Hunnicutt** has taken over the post of applications engineer, specializing in computer control and monitor systems for the electrical power industry of the Thompson-Ramo-Wooldridge Products Co. Creation of this new position is one result of the company's increased emphasis on power industry applications of its digital control computer, according to **Henry L. Bechard,** products manager.

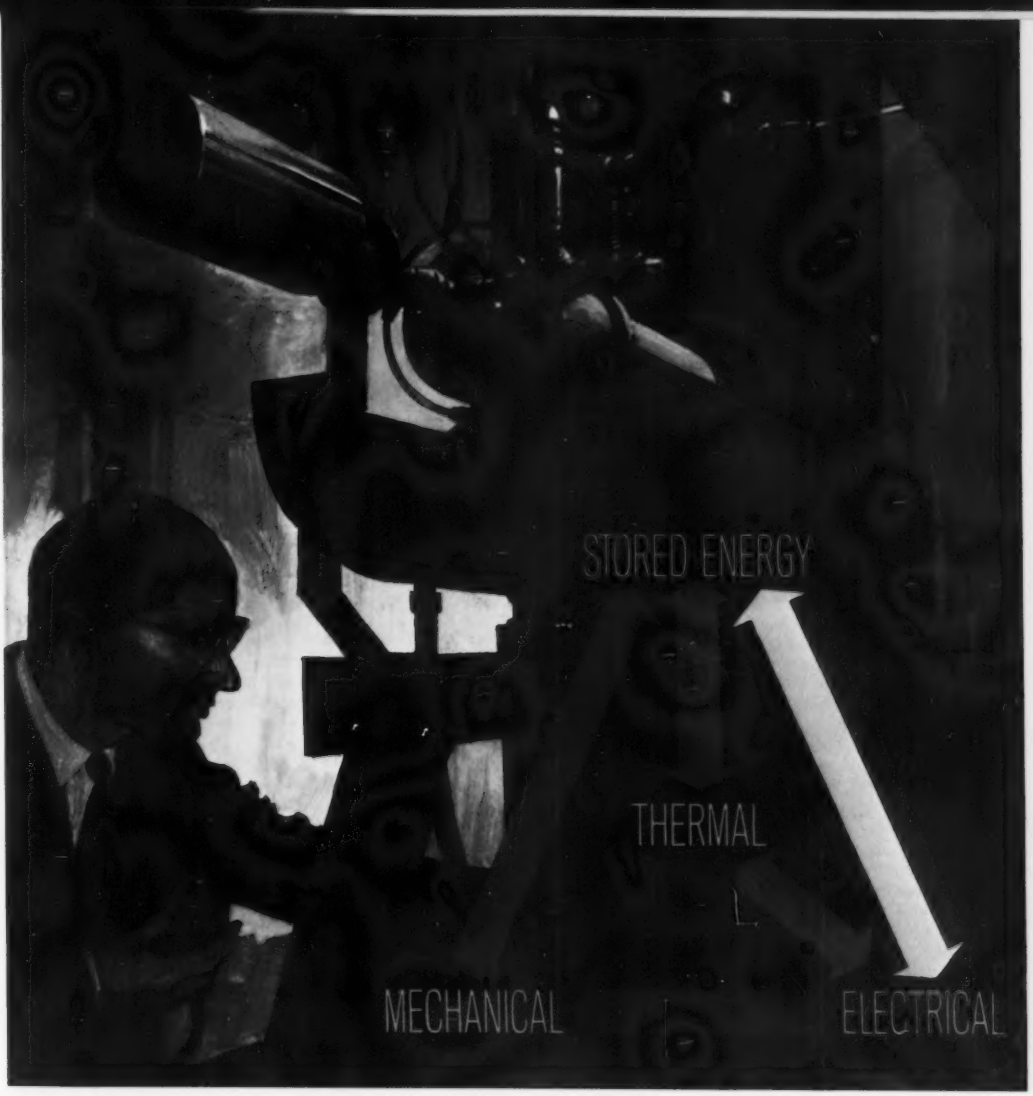
► **Orris Kendall "O. K." Buck,** 61, industrial sales manager, General Sales Division, Los Angeles Department of Water & Power, died July 1 following a heart attack. A graduate of the University of Washington, he had served the department for 38 years, beginning as a draftsman in 1922. In 1924 he was appointed junior electrical engineer and the following year was named power salesman. He was a leader in the industrial development of the San Fernando Valley, where he was the pioneer executive secretary of the Industrial Assn.

Buck

► **Joshua W. Viggers,** 83, an employee of Portland General Electric Co. for 42 years, died in July. A member of the first Pacific Coast championship basketball team, he was at one time basketball coach at Oregon State College.

► **Charles V. Foulds,** 66, consulting engineer, died in Portland on July 23. He was employed for many years by Pelton Water Wheel Co.

► **William E. Bumpas,** 68, of Loveland, Colo., an electrical engineer with the federal Bureau of Reclamation for 31 years, died Aug. 3 of a heart attack.



WESTINGHOUSE POWERCASTING*

probes four promising new power sources

Direct conversion methods promise high efficiency, low capital cost per kw

It is a certainty that the electric utility industry will utilize sources of power beyond conventional steam generation . . . and within the predictable future. For this reason, Westinghouse has for many years been engaged in an intensive program to develop methods of producing electric power by direct conversion. This program is broad front . . . all known possibilities are being investigated. Each of 38 Westinghouse laboratories is working on some phase of the problem. Many of these investigations are being initiated from a fund of pure knowledge gained through—and possible only because of—Westinghouse year-in, year-out program of basic research.

Development of advanced methods of power generation is being carried out to reduce, still further, the cost of generating electricity. They are being developed through the continuous search for economical generation for the future.

Four of these future power sources, Westinghouse believes, are standout possibilities . . . the fuel cell, thermionic, thermoelectric and magnetohydrodynamic generators.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE POWERCASTING* foresees efficiency gains up to 80% for fuel cell...challenges role of steam turbine-generators

2 TO 1, YOU'LL HAVE ONE OF THESE NEW POWER SOURCES ON YOUR SYSTEM

Fuel cell base load generator potentially twice as efficient as today's turbine-generator

The fuel cell probably will be able to produce twice the power, per unit of fuel, as today's most efficient steam generator. This staggering potential has prompted an intensive effort at Westinghouse to develop this system.

The energy released by the chemical reaction between a fuel and an oxidant is converted directly to electrical energy by the action of the fuel cell. The simple picture of a cell mechanism is an electrolyte sandwiched between two electrodes. An oxidant—usually oxygen—is supplied to one electrode where oxygen ions are formed. The ions move through the electrolyte to the second electrode where chemical combination occurs with the fuel. Electric power is obtained by connecting a load between the electrodes.

One prime reason for considering the fuel cell as a potential replacement for steam generation is the elimination of moving parts. Another is that efficiency is independent of the size of cell over a wide range of power output. The same fossil fuels can be used more efficiently and without the necessity of a heat cycle.

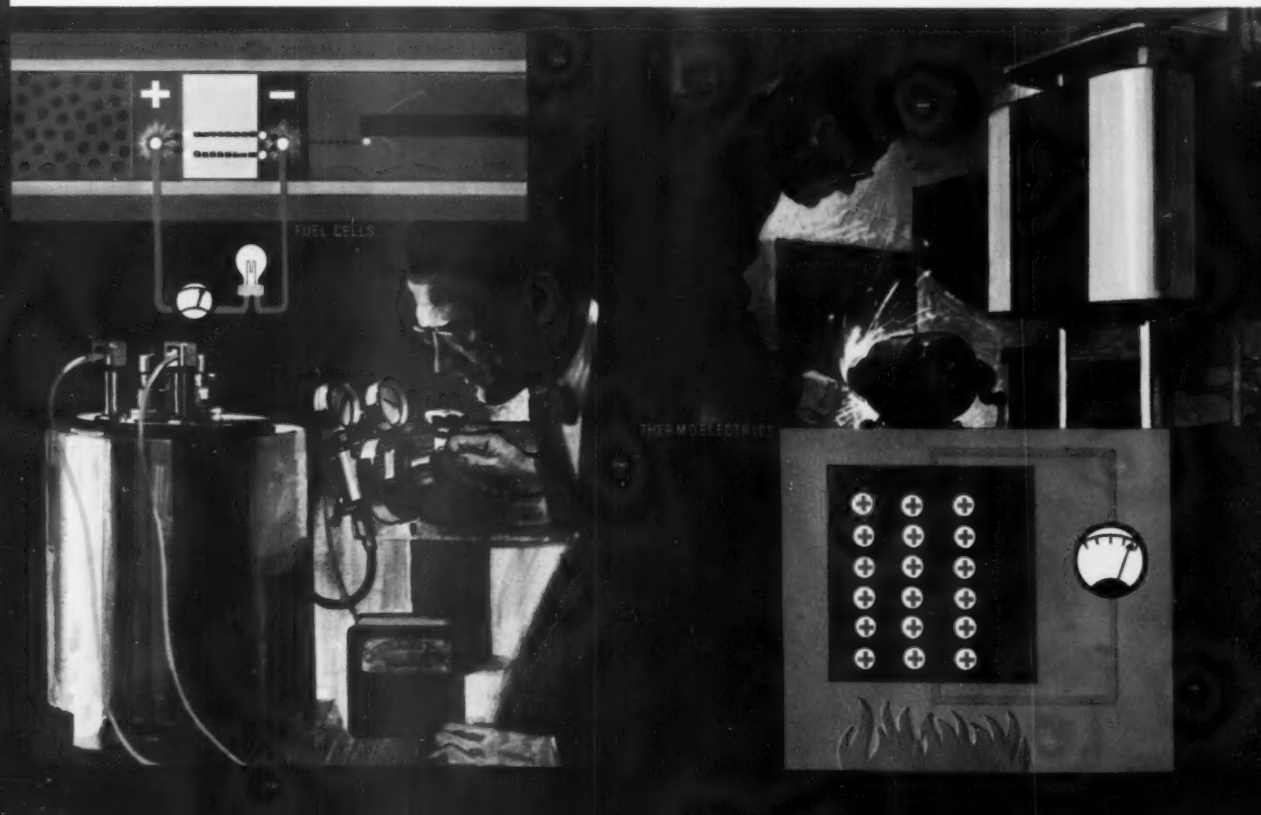
Today, materials do not exist for electrode and electrolyte which are at once resistant to high temperature corrosion, are highly conductive, yet low in cost. Westinghouse is attacking these complex materials problems. Because of this major effort, a new power source, within 15 to 20 years, may be available to you.

Thermoelectric peaking generator predicted for 1970's

Practical, economical thermoelectric power is a predictable generation opportunity within 20 years.

The thermoelectric effect occurs when heat is applied to one end of some materials . . . negative charges move to the cold side, the positive do not. In other materials, the opposite reaction will take place. Connected in series, these materials form a thermocouple. Electrical efficiency depends upon the ability of the materials to maintain temperature differential, on one hand, and substantial electron flow, on the other.

Studies have proved that semiconductors, half way between best insulators and best conductors, are the most efficient thermoelectric materials. Westinghouse



is currently conducting massive research among the hundreds of thousands of possible semiconductors to "build" optimum materials. To obtain high efficiency, thermoelectric conductors must be operated at high temperatures. In the quest for ideal alloys, the best materials Westinghouse has developed to date are 17% efficient. Based on present knowledge of materials, efficiencies to 30% are expected within 5 years. Breakthroughs to 50% or even higher values are not improbable.

A thermoelectric generator might well be constructed of many thermocouples in series, on a cylinder, for example, and fired by either fossil or atomic fuels. Large-scale devices face problems of corrosion, thermal and electrical insulation, heat and radiation dissipation, mechanical stresses. While problems are in almost fantastic variety, Westinghouse is attacking them all . . . with substantial progress in their solution.

The efficiency of thermoelectric devices is already competitive with small heat engines and is expected to improve rapidly. By 1970, Westinghouse expects to be able to build a 20% efficient, 100-megawatt generator for utility peaking service.

Thermionic topping unit can raise nuclear plant efficiency 55%

The third important Westinghouse development promising economic production of power by static equipment is the thermionic generator.

A thermionic power converter is essentially two conductive plates in an evacuated chamber. As heat is applied to the first plate, electrons are "boiled out" and flow to the second plate. This produces an electric current. The higher the temperature, the higher the efficiency of this generator.

Realization of a competitive thermionic device depends upon materials that can withstand high operating temperatures and maintain a low evaporation rate with high electron emitting capacity.

Looking ahead, Westinghouse sees this generator as a topping unit for a nuclear steam plant, taking advantage of high temperatures available. An atomic plant, at 27% efficiency, plus a thermionic plant, at 20%, offers an over-all efficiency of 42%. Efficiency of the thermionic device itself may theoretically climb to 50 or 60%, may cut up to one mil in fuel costs per kwhr.

10-kw fossil-fueled magnetohydrodynamic generator—largest in the world—foretells 380-mw equipment at 60% efficiency

Magnetohydrodynamics is the concept of generating electric current by forcing a gaseous conductor through a magnetic field.

Heated, ionized gas is passed through a magnetic field. Free electrons flow to an electrode at the top of the field, through a load to another electrode at the bottom of the field, creating a current. An ionized gas, at 4000°F, is used as fuel. Its velocity is between 2000 and 4000 miles per hour through a combustion chamber inside the magnetic field. The gas functions the same as rotating copper through a conventional generator.

Westinghouse is pointing toward magnetohydrodynamic generators ranging above 100 megawatts, using an atomic reactor to heat the gases to perhaps 4200°F. Calculations on a 380-mw design, for example, disclose a possible, practical operating efficiency of 60%, a reduction in fuel costs of possibly 1¼ mils per kwhr. A variation of this large-scale generator might burn fossil fuel, the combustion products passing through the system.

What are the problems presently standing in the way of an economical, commercial-size unit? Temperatures for these systems start at 3500°F. New magnetic and electrode materials must be developed which will maintain structural strength for 20 years above these temperatures. These materials must contain the gases under extreme temperatures at velocities up to 4000 mph . . . without adverse chemical reaction. The problems are impressive . . . but so is the plan to conquer them. A broad and definite program of research and development may one day enable Westinghouse to offer you a completely proved, highly efficient magnetohydrodynamic generator.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE POWERCASTING* develops new concepts of power system planning, equipment for economical industrial growth

Westinghouse Powercasting is a continuous plan of action devoted to the stable growth of the electric utility industry. Toward this end, Powercasting has created a method of predicting your future system needs accurately. Concurrent with this activity, Westinghouse carries on a program of product development for generation, transmission and distribution, geared to the needs of the industry's future systems.

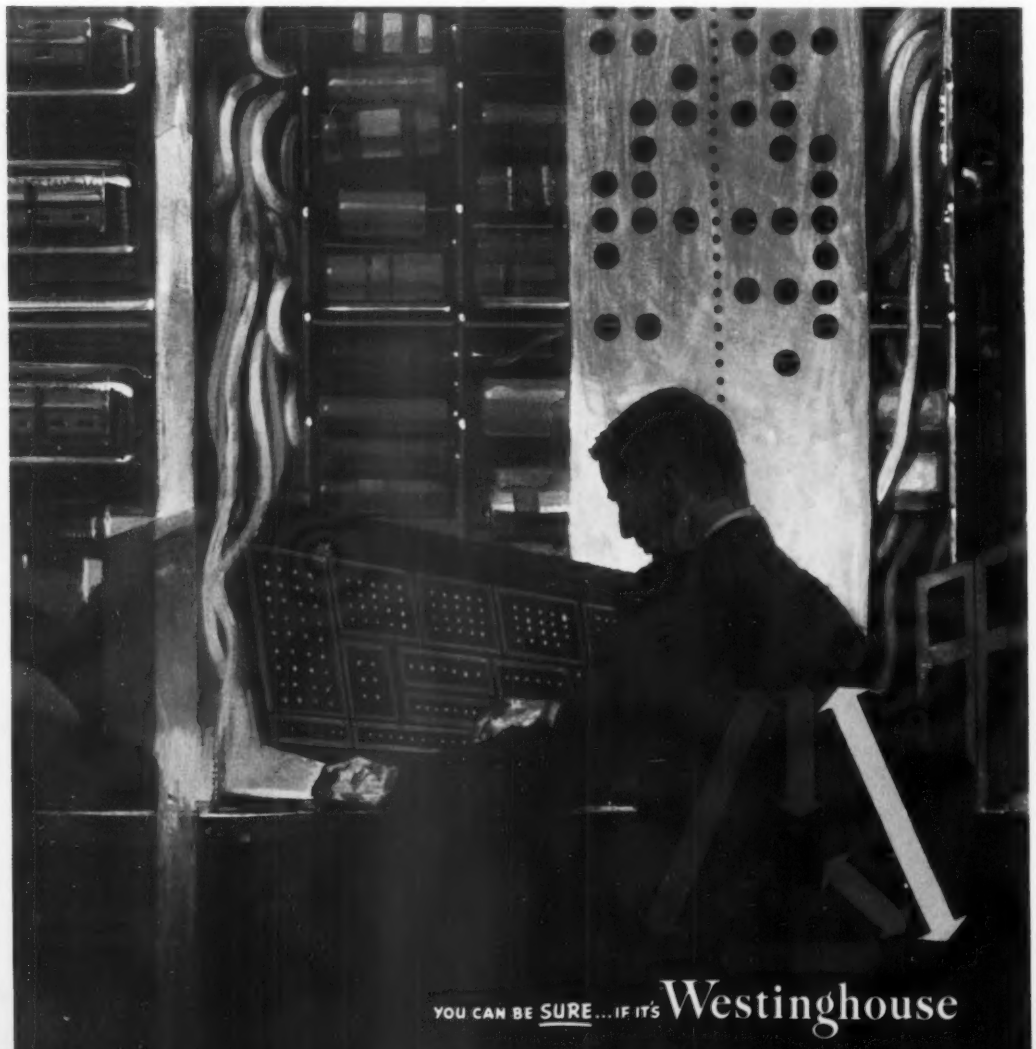
One area of research receiving intensive attention is direct conversion generation, discussed on these pages. These power sources are potentially more efficient than steam generation—some by a wide margin. Capital costs are potentially lower. Any or all of these plants may one day fill new, cost-saving roles on your system. While foreseeable improvements in the steam plant may cut ⅓ mil from fuel costs, the fuel cell, for example, may reduce these costs by as much as 1¾ mils. As a base load generator, this device alone could mean per annum savings of hundreds of millions of dollars to the industry.

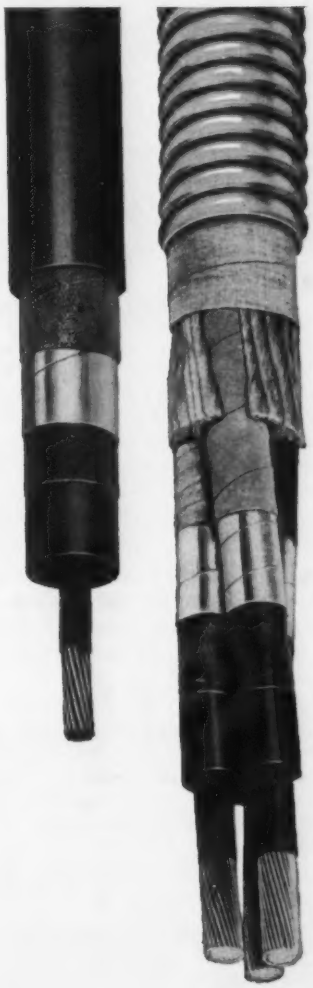
Concurrent with this broad-based product development, Powercasting is setting up system planning guideposts for the application of revolutionary new equipment. It is the task of Powercasting to be prepared for major breakthroughs . . . to determine which power sources will be most economical, when, in what sizes, and in what type of service on your system. Capital outlays, operating costs, transmission and distribution requirements and new areas of product development must also be analyzed. Altogether, to develop sound concepts of power system expansion and operation, Westinghouse Powercasting searches the entire field of the fundamental sciences for new knowledge, new ideas.

For more information about future power sources, get in touch with your Westinghouse representative.

CP-1057 Litho in U.S.A.

*A Service-Mark of Westinghouse





how good should power cable be

...*for long term stability?*

It isn't enough to meet or barely surpass specifications—not when it is possible to build maximum performance into power cable—as Circle does. Take, for example, the IPCEA-NEMA 60 cycle water absorption test.

Circlesheath® Type RR Power Cable Performance

In the IPCEA-NEMA "Accelerated Water Absorption Tests," Section 6.9, a sample of power cable is immersed in 50°C water for a period of 14 days during and after which time specific inductive capacity and stability factor are measured.

Not only does Circle butyl-insulated power cable far surpass all minimum specifications after 14 days immersion—*but continues to do so after one year and eight months of continuous immersion. And the test is still going on!*

Date of original immersion: September 1958 Date of last test: April 1960

CABLE DESCRIPTION: 15KV, UNGROUNDED, SHIELDED	CIRCLESHEATH® CHANGE SIC	PERFORMANCE STABILITY FACTOR
700,000CM	4.3%	.6%
300,000CM	3.9%	.5%
300,000CM	3.6%	.4%

IPCEA-NEMA Requirements: Change SIC 1 to 14 days: 5% max.— stability factor after 14 days: 1% max.

The manufacture of high-reliability power cable is no accident. It requires expert knowledge of compounding techniques, absolute quality control—and production men who not only care enough . . . but *know enough* to produce the very best.

Circle CIRCLOC® Interlocked Armored Cable combines flexibility with mechanical protection in one lightweight, economical construction. It trains easily over obstructions; is ideal for future plant expansion. Available in galvanized steel, bronze or aluminum armor—from 600 to 15,000 volts.

CIRCLE WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

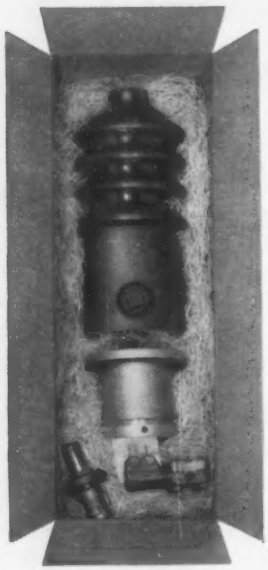
RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE •
PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE® EMT

UNIT PACKAGING

IMPROVES DELIVERY; CUTS INVENTORY AND COSTS!

G&W's unique Unit Packaging program saves you time and money. Every component, device, and accessory required for the installation of a G&W standard Pothead or oil-filled Cutout is quickly gathered from "off-the-shelf", carefully and securely packaged, and sent to you *complete* in a single carton or crate. Once put into your inventory, it is a simple matter to take from stock as many individual boxes as required, load on a line truck, unpack right at the job site, and put the units into service in short order. You not only effect substantial savings on inventory control and handling, but materially cut installation costs.

Unit Packaging is another benefit you gain from G&W's constant development of cable accessories and switchgear. Further proof, too, that you are dollars ahead by relying on G&W's 55-year record of dependability and quality. A G&W representative will assist you in solving any cable accessory or switching problem, or write us for full detailed information.



A standard capnut pothead ready for shipment as a typical unit package.

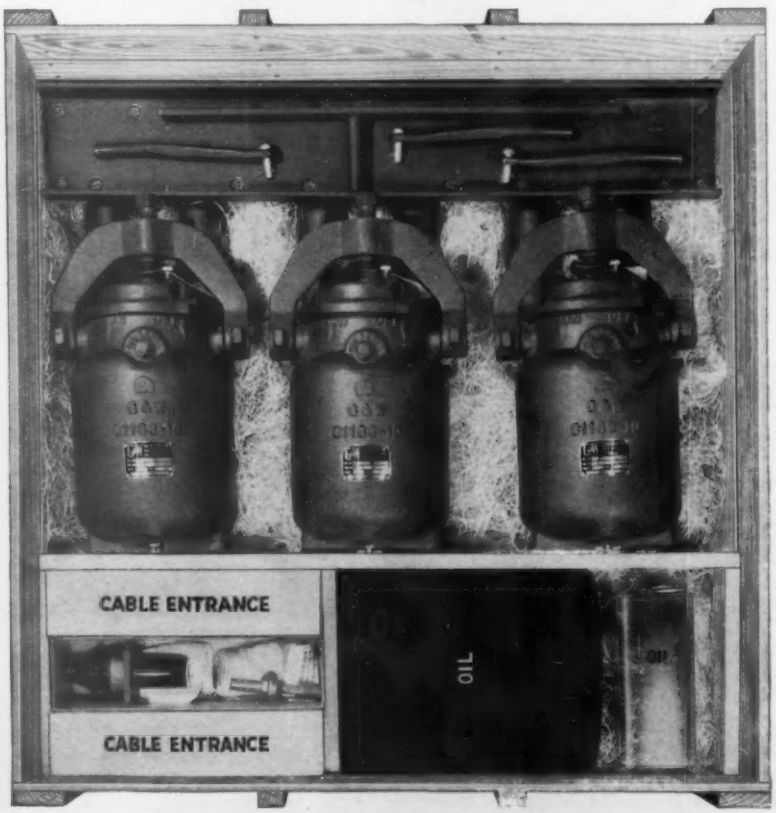
All components and oil for three, gang-operated oil-filled cutouts are shown in this typical unit package.

G&W ELECTRIC SPECIALTY COMPANY

3506 West 127th Street, Blue Island, Illinois

CANADIAN MFR. • POWERLITE DEVICES, LTD. • TORONTO, MONTREAL & VANCOUVER

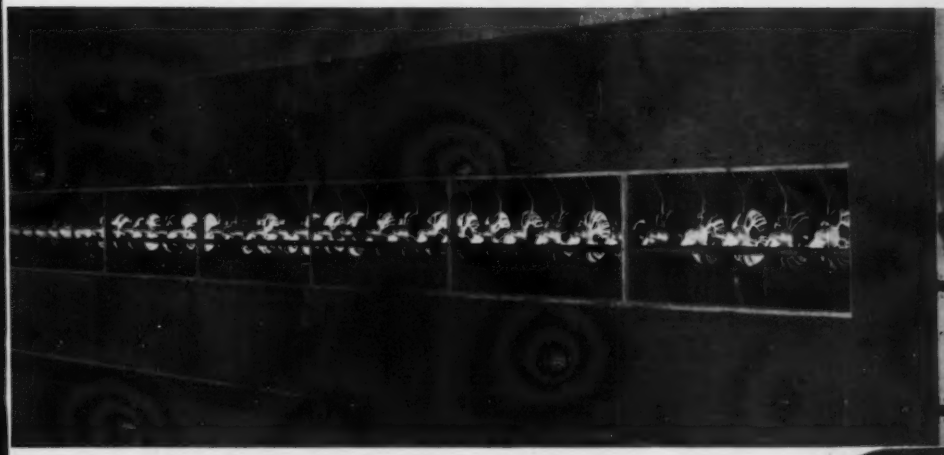
superior quality standards — inspired specialized design

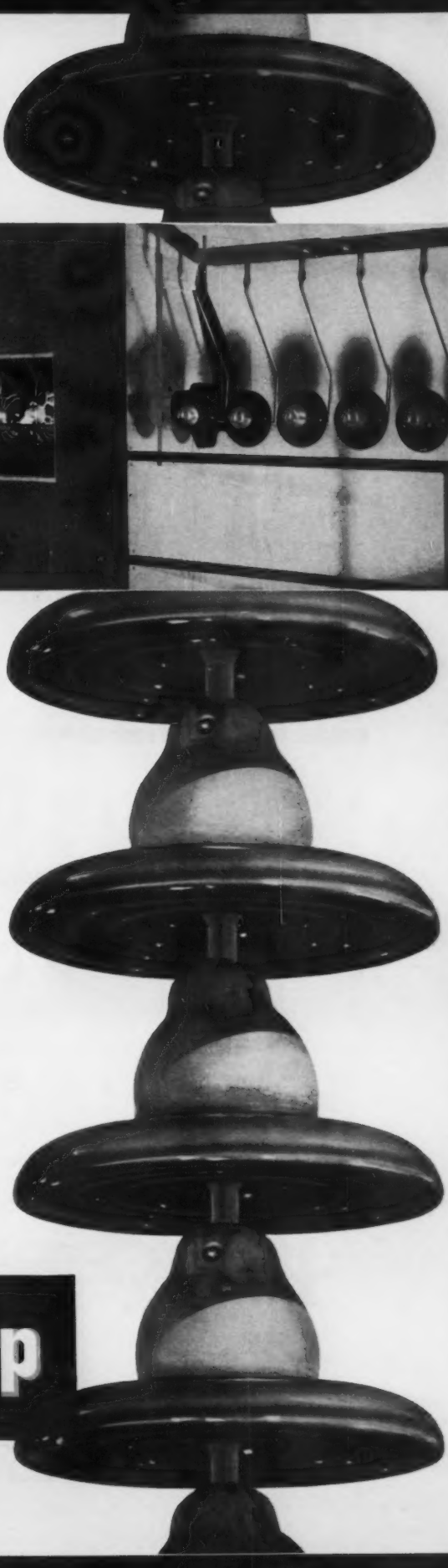


G60-2

For phone number of closest representative see advertising index in back of book.

We make 'em good





...and we make 'em prove it!

You never see a Lapp suspension insulator until it's been proved equal—or superior—to your specifications.

This high frequency flashover test is one of the many ways we prove our insulators. We put every unit through electrical and mechanical punishment far beyond what it should experience in service. And we keep production uniform, for predictable performance on your lines.

Testing is part of the continuous program of product improvement at Lapp. We keep making 'em better—and we prove each improvement.

But our tests are only physical proof. You may be more impressed by the dollars-and-cents proof in your own operating record. See what your Lapp insulators have saved you in maintenance and replacement costs. Add up the months of uninterrupted service on your Lapp-insulated lines. And remember it next time you order.

Lapp

Lapp Insulator Co., Inc.,
Le Roy, N. Y.

WESTERN REPRESENTATIVES:
Los Angeles: Earl S. Condon Co.
San Francisco: Donald E. Ingalls
Seattle: Charles F. James
Butte: R. E. McDonough Co.
Salt Lake City: Riter Engineering Co.

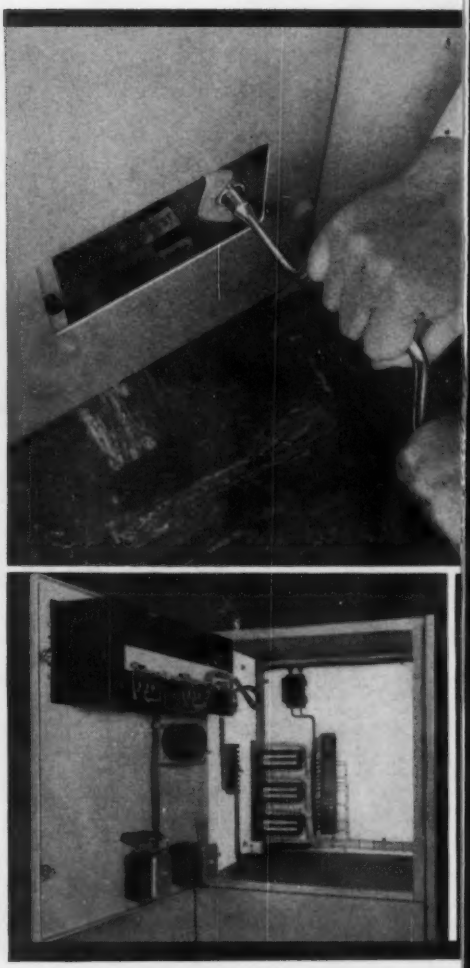
NEW COMPACTNESS

NEW SAFETY

NEW EASE OF ACCESS

NEW STORED ENERGY

This is the all-new I-T-E type HK metal-clad switchgear



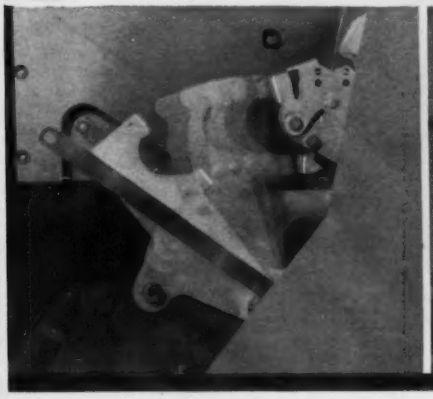
Roomy interior for easy access. Only I-T-E gives you a separate 30-in.-high instrument compartment, completely isolated from the high-voltage compartment. And it's closer to the floor, so you can reach into it easily. Put your elbows in and work in comfort. High visibility white interiors simplify installation and trouble shooting. Your control wiring can easily enter from the bottom or through the top sheet.

Free detailed bulletin—new strip film. Get the whole story about *all* the new advances in this I-T-E metal-clad switchgear. Learn about its easier operation, greater safety, and superior protection. Send for Bulletin 2801-2A. And ask also to see the new sound strip film. Can be shown to you singly or to your group. Contact your nearby I-T-E sales office or write I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

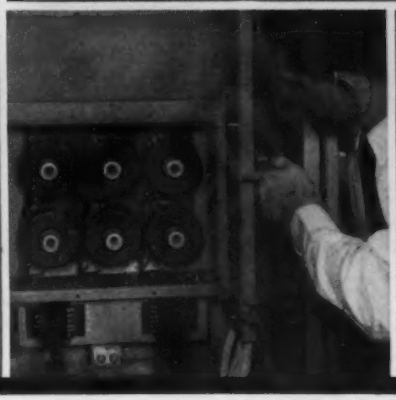
For phone number of closest representative see advertising index in back of book.

Fits where others won't. This is a 4160 volt switchboard. See how low and shallow it is compared with old standards. It's only 80 in. high and 58 in. deep. So it saves both floor space and overhead space. Goes easily under low ceilings. Fits in narrower aisles. And its reduced height puts all instruments at easy-to-read eye level. Roomy cable compartments at the rear are accessible through hinged doors. All insulation in the switchboard and circuit breakers is flame-retardant and track-resistant.

Closed-door drawout. The door stays closed while the breaker is moved from connected . . . through test position . . . to disconnected and back. There's always solid steel at ground potential between the operator and the live parts of the gear. Even an inexperienced man is completely safe. Since doors stay closed, aisles need never be cluttered. And foreign matter can't get into breaker compartments.



Stored energy closing. This is not simply a new feature added to an old design. It is integrated into a completely new circuit breaker design. Gives you fast, uniform closing every time. Prolongs contact life. And you can close the circuit breakers even without control power. For greater economy, the spring charging motor draws only one-tenth the current of previous methods.



Easy-to-change current transformers. They're accessible from the front. You don't need to disturb your cable connections at all. Just remove the shutter barrier assembly over the primary studs, and there they are. As this view shows, you can locate current transformers on both load and line sides of the circuit breaker, providing more flexibility in relaying.

Compact 4160 volt circuit breaker. Low center of gravity permits easy, safe, one-man maintenance. High-strength, flame-retardant track-resistant moldings eliminate need for structural metal above the base frame. Provides insulation strength where needed most. Arc chutes tilt for easy inspection. Lift off without tools. Modern materials and new design result in substantial reduction in circuit breaker size.

I-T-E CIRCUIT BREAKER COMPANY

for the latest data on ACSR

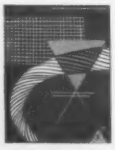
126 fact-filled pages...from Alcoa

It took more than 60 years to prepare these three publications.

Recently completed tests have made it possible to review and revise data accumulated since 1897, the year Alcoa launched a continuous research program on overhead aluminum conductors— *both all-aluminum and ACSR*. The most up-to-date information has been put into book form to help you in your job:

Design or operation of transmission lines is your problem. Maybe you're called on to predict the resistance and reactance of a proposed transmission line. Are available data good enough? This 90-page book supplies you with new information on resistance and reactance—information that can help you accurately evaluate the effects of the steel core on electrical characteristics. TITLE: *Resistance and reactance of aluminum conductors.*

How much heat loss can you expect from convection? Tough problem. One that's complicated by the chimney effect of a heated conductor. And varying wind conditions. This 20-page publication provides up-to-date information on heat dissipation caused by convection and radiation. TITLE: *Current-temperature characteristics of aluminum conductors.*



Electrical requirements on your system go up. You need to operate conductors at higher temperatures than in the past. You ask yourself: what about creep effect? Here's a 16-page booklet that provides easy-to-use answers to many questions on how aluminum conductors behave when subjected to various conditions of heating by high overload currents. TITLE: *Overload and fault current limitations of bare aluminum conductors.*

Ask any one of our representatives for your copy of these new publications. Written requests on company stationery should be mailed to Rome Cable Division of Alcoa, Dept. 4-90, Rome, New York.

ALCOA
ROME CABLE DIVISION

For phone number of closest representative see advertising index in back of book.

CONTRACTING & CONSTRUCTION SECTION

STATISTICS / COSTS / PROPOSED PROJECTS / NEW PRODUCTS / NEWS

LATE NEWS FLASHES

Pension Pressure Building Up

Strong indications, still not in the open, are that the next fringe the electricians will ask for will be a local pension plan in addition to that carried jointly by the IBEW and NECA at a national level, and to which both contribute. This will further complicate contractor bookkeeping, already loaded with accounts (and penalties) for health, welfare, vacations, sales promotion and education, holidays and high time, which must be maintained for the state and federal government, the union, the men and the office files. When paper work exceeds electrical work, will that be the point of diminishing returns?

NECA Managers Really Work

"Most satisfactory meeting ever held" of NECA chapter managers preceded the District 9 NECA Chapter council meeting at Sacramento in mid-August. All but three chapters were represented and the entire business of running a chapter from A to Z was wrestled with under Charles Scholibo's ringmastering in sessions from early morning until near midnight for the two days. Bob Wilkinson of Spokane was elected the tri-district chairman; George Flint of Stockton, chairman for District 9 managers.

Bad Bidding Bother

Bid practices have grown so sharp that they have become one of the major worries of the construction business. In Los Angeles, the general contractors are trying out a four-hour moratorium plan to see if it will work well enough to avoid more legislation on the subject. Another approach is being made by a 10-man com-

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121 READER SERVICE SECTION

LATE NEWS FLASHES

Continued from p 95

mittee of the AGC and CILC to reach the bid peddling and shopping evil through changes in the law and responsibilities of the California State Contractors License Law.

New Brass Appears

Robert Higgins, newly appointed NECA assistant executive vice-president, and James Swan, NECA's new labor relations director, attended and counseled with the District 9 chapter manager, officers and council delegates at the Sacramento meeting Aug. 12-13 under Vice-president Norman Ferguson of San Diego. Charles Foehn, recently appointed IBEW District 9 vice-president, spoke to the meeting also.

Bellingham Wage Increase

An increase of 13¢ an hour is agreed to in a new one-year contract between the Bellingham Division, National Electrical Contractors Assn., and Local 1032, IBEW. Ten cents an hour was retroactive to Aug. 1 while an additional 3¢ becomes effective Jan. 1.

"Sales—Finance—Production—Profits"

A program arranged to balance these phases of the electrical contracting business is being arranged for the national convention at Las Vegas Convention Center Oct. 19-27 in conjunction with NECA's national Electrical Exposition. The exposition and open meetings will be from Oct. 24-26. The executive committee and the board of governors hold meetings prior to the general sessions. Some 3,500 contractors and guests are expected for this 59th anniversary convention. Elections for vice-presidents for four districts, among them 6 and 8 in the Western states, will be held at the time.

Antitrust on the Prowl

Under supervision of Assistant Attorney General Wallace Howland, William C. Dixon has been borrowed from the U. S. Department of Justice Antitrust Department, with a title of special assistant attorney general, with office in Los Angeles. He is said to be looking in particular into the construction industry for evidence of antitrust violations under the state's Cartwright Act. Federal action has been taken recently against a number of the industry's largest manufacturers of electrical equipment and supplies.

Arizona EJIB Campaigns Again

That lighting, heating and cooling must be integrated in building design which will mean more business for electrical contractors and greater benefits to business was the basis for this year's promotion of Arizona's Electrical Joint Industry Board in cooperation with the Arizona Public Service Co. J. D. Whitnell, commercial sales engineer, outlined the program to more than 50 Phoenix area contractors. The higher recommended foot-candle levels now being used will mean more difficult heating and cooling problems, he pointed out and should bring changes in building design. Advertising following that theme is being sent out over the signature of the EJIB with contractor follow-up.

New Contra Costa Code

The electrical code for Contra Costa County, Calif., has been amended by ordinance No. 1427. It adds some requirements to those of the NEC, deletes others and specifies where a choice is to be made. It follows in general the recommended uniform ordinance, a project of East Bay area inspection departments.

Here are the Graybar Offices in the West

ARIZONA

Phoenix:	1700 North 22nd Ave. ALpine 2-2371
Tucson:	212 South Park Ave. MAin 2-6439

CALIFORNIA

Bakersfield:	2828 "K" St. FAirview 4-4755
Fresno:	2626 Hamilton Ave. ADams 7-4175
Long Beach:	800 West 16th St. HEmlock 2-2911
Los Angeles:	210 Anderson St. ANgelus 3-7282
Oakland:	1911 Union St. GLencourt 1-5451
Oceanside:	805 N. Tremont St. SAratoga 2-2141
Sacramento:	1900 - 14th St. HIckory 4-8830
San Bernardino:	655 South "H" St. TUrner 9-1051
San Diego:	720 State St. BEImont 3-1361
San Jose:	1376 N. Tenth St. CYpress 2-9090
San Francisco:	1750 Alameda St. MArket 1-5131
Santa Ana:	301 French St. Kimberly 3-8309
Santa Barbara:	329 S. Salinas St. WOodland 5-1013
Van Nuys:	15520 Cabrito Road STate 2-9600

COLORADO

Colorado Springs:	630 West Vermijo Ave. MElrose 4-3701
Denver:	104 Wazee Market TAbor 5-7111

IDAHO

Boise:	1325 Idaho St. BOise 3-2594

MONTANA

Butte:	604 E. Aluminum St. BUtte 3233

OREGON

Eugene:	2380 West Broadway Diamond 4-2224
Portland:	N.E. 60th and Banfield ATlantic 8-5661

UTAH

Salt Lake City:	336 North Third West St. ELgin 9-8771

WASHINGTON

Seattle:	King & Occidental Sts. MUtual 2-0123
Spokane:	West 1033 Gardner Ave. FAirfax 7-6611
Tacoma:	2112 "A" St. MArket 7-0164

FOR IMMEDIATE SERVICE ON EVERYTHING ELECTRICAL CALL THE OFFICE NEAREST YOU

You can save money on crew time with Graybar as your auxiliary warehouse

On a single Graybar order, you can enter all the materials you need for, let's say, a complete distribution line project . . . and you will receive every item on schedule. Starts need not be delayed for lack of materials if Graybar is your auxiliary warehouse.

When the unexpected happens . . . emergency requirements . . . additional fill-in items . . . special tools . . . call Graybar. We are geared to handle the unusual. Even on large transmission line projects, we furnish prefabricated crossarm assemblies . . . another time-saving specialty of Graybar.

Start with a local call . . . Call in your local Graybar man and talk it over with him.

Employee-owned Graybar has been "on the line" and part of the local scene for years. Whether you require 3 items or 3,000, Graybar is your most practical source for most utility electrical equipment and supplies.

When Graybar is your auxiliary warehouse –

- You save on storeroom costs
- Reduce inventory investment
- Insure prompt delivery
- Step up man-hour efficiency
- Simplify bookkeeping

935

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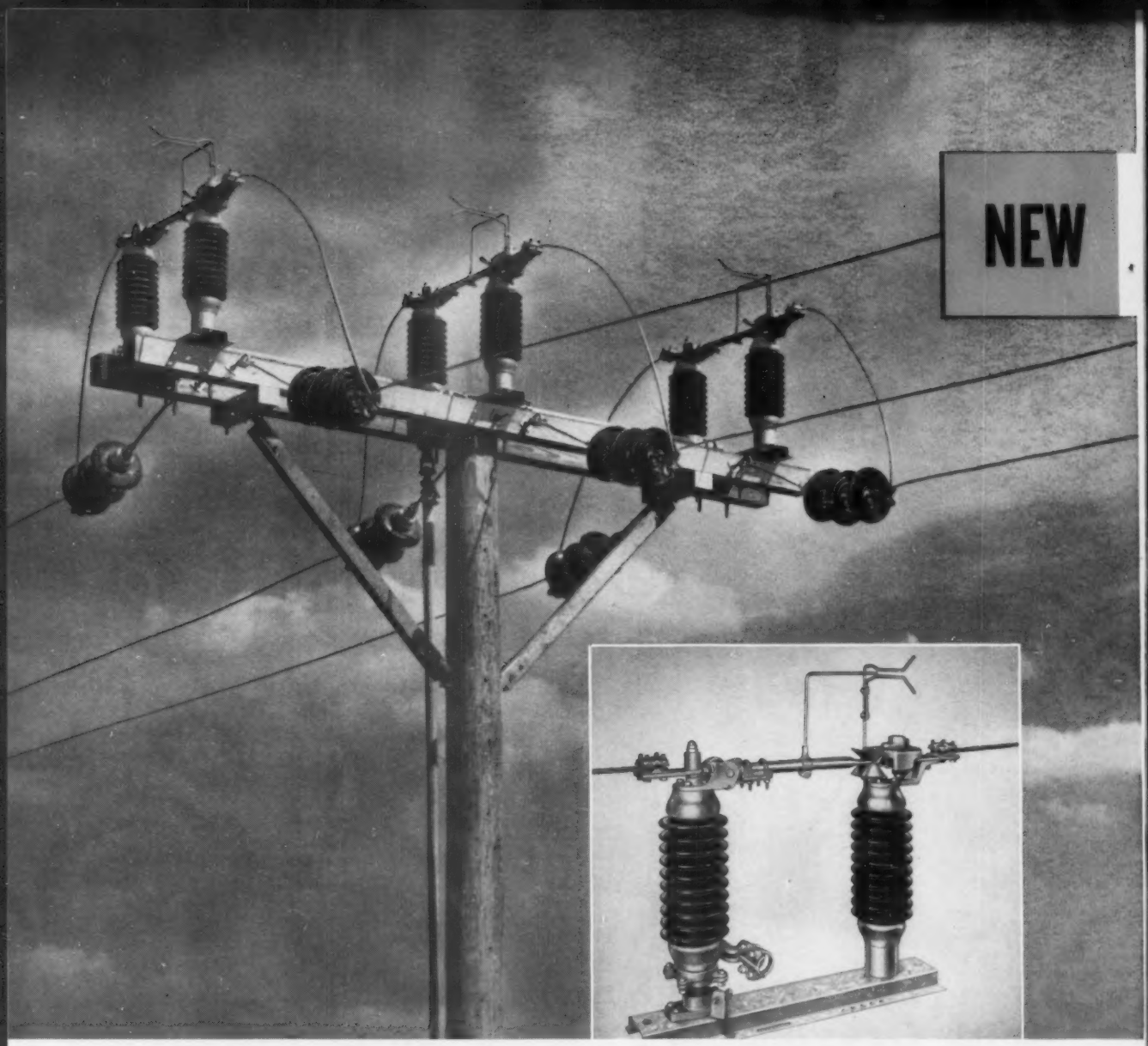
ELECTRIC COMPANY, INC.

420 Lexington Avenue, New York 17, N.Y.

Everything Electrical · GraybaR Electric Company

IN OVER 130 PRINCIPAL CITIES

LOCAL SERVICE TO UTILITIES THROUGH COAST-TO-COAST WAREHOUSING



NO OTHER SIDE-BREAK DISCONNECT GIVES YOU ALL OF THESE OPERATING ADVANTAGES

- **Correct contact always maintained at blade tip even if crossarm warpage distorts the switch base.**
- **All blades engage fully in the break-contact jaws without precise adjustment of the inter-phase rods.**
- **Less time and labor to install with Kearney original wide-tolerance mechanical design.**
- **Easiest, surest ice-breaking ability available on both opening and closing.**

This newest Kearney development solves long-existing operating problems of crossarm mounted group operated side-break disconnects. The best supporting structure or crossarm construction may . . . due to ice loads, age, wind or line strain . . . deflect enough to distort the switch bases, or alter the relative positions of the three phases. This often causes loss of contact or failure of all blades to close completely in conventional disconnects with both rigid blades and stationary break-contacts.

Kearney's advanced design features a self-aligning blade constructed to permit controlled vertical movement and axial rotation. This automatically compensates for base distortion . . . keeps the blade tip correctly aligned in the contacts. The break-contact swings 30-degrees with the blade as it is opened or closed, producing high leverage ice-breaking ability and full wiping of the silver current transfer surfaces. On closing, the blade tip fully engages the break-contact before the contact moves from its angular open position, compensating for any shift in position of the switch bases. This same feature also allows considerable freedom in interphase rod adjustment, enabling Kearney *Self-Aligning* side-break switches to be installed faster and more economically than other types.

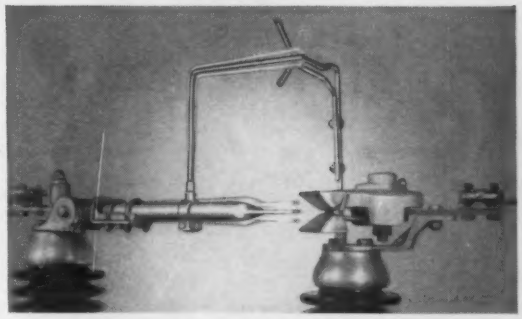
The details of these original features for maintenance-and-adjustment-free operation are shown on the facing page.

Kearney's

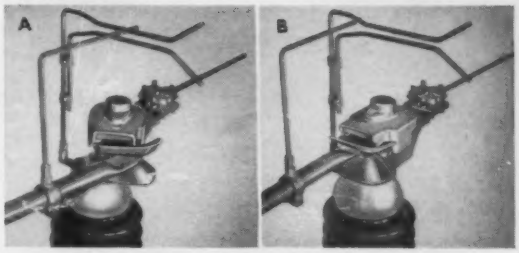
Self-Aligning SIDE-BREAK DISCONNECTS

...always make positive contact, even if the supporting structure warps, twists, bows or settles.

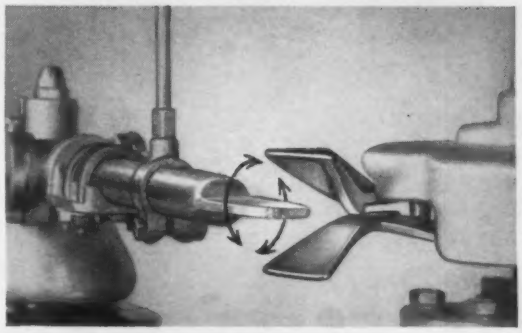
Self-aligning blade moves in a vertical plane to re-establish the original relationship between blade tip and contacts if supporting structure warpage distorts switch base. Wide mouth contact jaws assure blade entry into the contacts. Vertical 1¼" movement more than corrects for extreme cases of misalignment.



Break-contact swings 30° in the plane of blade travel as switch is opened or closed, providing highest leverage ice-breaking and full wiping of the current transfer surfaces. Note that the blade tip is fully engaged, and full contact is maintained (A) through the final 20° of blade travel to the fully closed position shown at (B). This feature allows more latitude in phase rod adjustment than other designs.



Blade rotates 12° on its longitudinal axis. If base distortion has affected blade-contact alignment, the blade tip will rotate as it enters the break-contact to keep all contact surfaces parallel, automatically restoring contact alignment. Friction reducing construction at all rotation points minimizes operating effort.



Switch carries full-rated load current well within NEMA temperature rise, from a fully closed position to 20° partially open position. Ratings available, 7.5 through 69 kv, 600 amperes. Equipped with conventional or whip-type arcing horns... torsional or spade-type operating mechanism. May be mounted horizontally, vertically, or underhung.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Missouri

IN THE WEST: for prompt service, contact Kearney's West Coast Distributor, **Maydwell and Hartzell, Inc.,**
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FOR BETTER CONSTRUCTION... SAFER MAINTENANCE

Specify Kearney Products

Plants at: **ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA**

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"Superforms* sure fill the bill for a STANDARDS ENGINEER!"

"Fanner Superformed products meet our standards all along the line . . . *technical superiority, accurate manufacture, uniform quality, dependable performance.*"

More and more Standards Engineers . . . *the men who must find BETTER ways to do things BETTER* . . . are testifying that Superforms meet the highest standards. A-1580A

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ARMOR RODS . . . Protect long-span T&D lines at supports

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PATCH RODS . . . Repair damaged conductors

TAP ARMOR . . . Protects conductor at tapping points

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The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

Motors and Controls—XV

A Closer Look at Our Problem

TOM HUGHES, CALIFORNIA DIVISION OF INDUSTRIAL SAFETY

So we had these three fundamental types of running protection during the Twenties and they served us fairly well because the majority of motors were used on continuously running loads with infrequent starts. Since there was little diversity in in types and operating characteristics of three-phase induction motors the overload relays were fairly standard and their regulation easily understood by maintenance personnel.

Today we have not only a confusion of motor types and applications but a parallel confusion in the styles of motor protective devices available and their proper application. In the end, we want to bring order out of all this but first let's bring these three early types up to date.

Now, let's agree to a class that they may fall in. We will say that they (in general) are noncoordinated with the actual set of conditions found at the motor. In other words, the person applying them to the motor must make a complete analysis of load characteristics, maintenance factor, ambient temperatures involved, etc., and then properly apply the protector to the conditions of that particular setup. If the motor is later moved to a different ambient or the load characteristic altered, the protector will no longer be properly applied.

Later, when we have built a better foundation, we will discuss a class of protection that we will call a **Co-ordinated System.** That is: coordinated with the actual temperature of the motor winding so that, once it is properly set up, we care not where the motor is placed nor how the load is varied in so far as protection of the motor is concerned.

We realize that manufacturers of the three types of protectors we have thus far described would take issue with us on such a designation. Inasmuch as their products are coordinated with the actual current that drives the motor (which we are trying to protect) and our very terminology has long used the phrase: "running-overcurrent" protection to differentiate from the "branch circuit" (short circuit) protection.

But, until we have gone more into the merits of the case this is no proper place to argue on terminology; though misguided terminology is certainly at the root of many confused and continuing controversies in the electrical industry today. So, let us class these as noncoordinated protective devices and then take a closer look at their present merits and application.

Let us state unequivocally that they have stood the test of time; they are presently available in many styles and variations; and (because of their popular use and demand) they have been the most economical solution to polyphase motor protection that we could buy over distributor's counters. Of course we have ignored the dual element fuses with which our readers need little enlightenment. They too are finding their place as a fourth type of noncoordinated protection.

So let us discuss the merits of these three devices that are usually integrated with controllers, their good points and the things about them that make us unhappy. We call them (in the vernacular of electricians) thermal overloads, solder pots and dashpot relays. But they are actually known in professional circles as thermal relays of two classes—bimetallic and melting alloy; and magnetic overload relays.

The various faults and merits of the different types will vary as we cross from one manufacturer's line of relays to another's because some have concentrated on development in one type while others have expended more care on another.

Starting with what we call the "thermal": for simple motor loads such as continuously running blowers and pumps, working on a steady head, they can't be beat. They are also adequate for use on machine tools and other such processing equipment, where they are seldom loaded up to rated capacity and not subject to frequent starts.

However, for continuously varying loads in the neighborhood of the motor's rated capacity, or frequent starts, they are practically worthless. Oh, of course, a practiced application engineer can juggle the many factors involved and arrive at a much closer match but (as we shall show

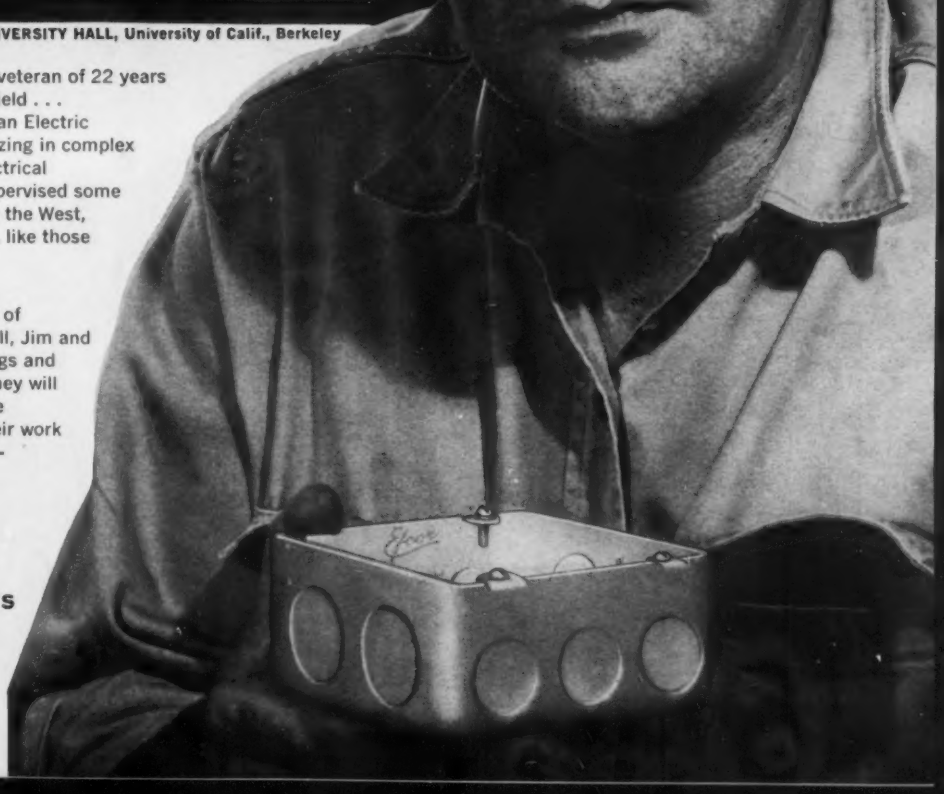
Continued on p 103

The men who really know...know Efcor

UNIVERSITY HALL, University of Calif., Berkeley

Meet Jim Mahaney, seasoned veteran of 22 years in the electrical construction field . . . superintendent for the Coopman Electric Company; contractors specializing in complex commercial and industrial electrical installations. Jim, who has supervised some of the most interesting jobs in the West, insists on quality products . . . like those manufactured by Efcor, for a trouble free job.

For instance, in the University of California's new University Hall, Jim and his men have used Efcor fittings and boxes in an installation that they will be proud of for years. Men like Jim Mahaney take pride in their work . . . **the men who really know—know Efcor.**

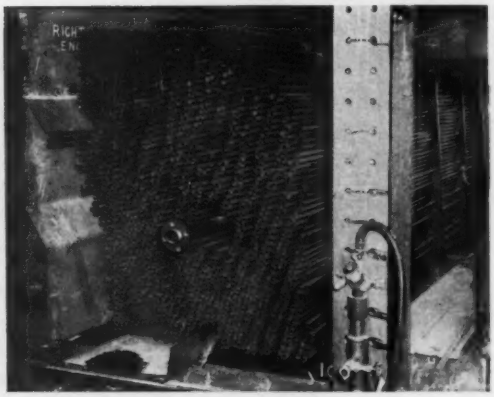


EFCOR

ELECTRICAL FITTINGS CORPORATION

WOODSIDE 77, NEW YORK

New Dickerson Station of Pepco equipped with over 170 miles of Phelps Dodge Condenser Tubes!



The newest power station of the Potomac Electric Power Company at Dickerson, Md., fills a big need for increased electric power in the greater Washington, D.C., area. The plant's two mammoth generating units, each with a capacity of 175,000 kilowatts, boost PEPCO's total electrical capacity by nearly one-third.

Within the giant condensers of the units are more than 170 miles of Phelps Dodge Admiralty and Cupro-Nickel condenser tubes weighing over a half-million pounds. These tubes were specified because of their record of proven dependability and long service life in similar operating conditions.

In every industry that uses heat transfer equipment, Phelps Dodge tubes are known for their lasting quality. This reputation has made Phelps Dodge a leading fabricator of copper and copper-alloy tubes for the manufacturers of condensers and heat exchangers.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N.Y.

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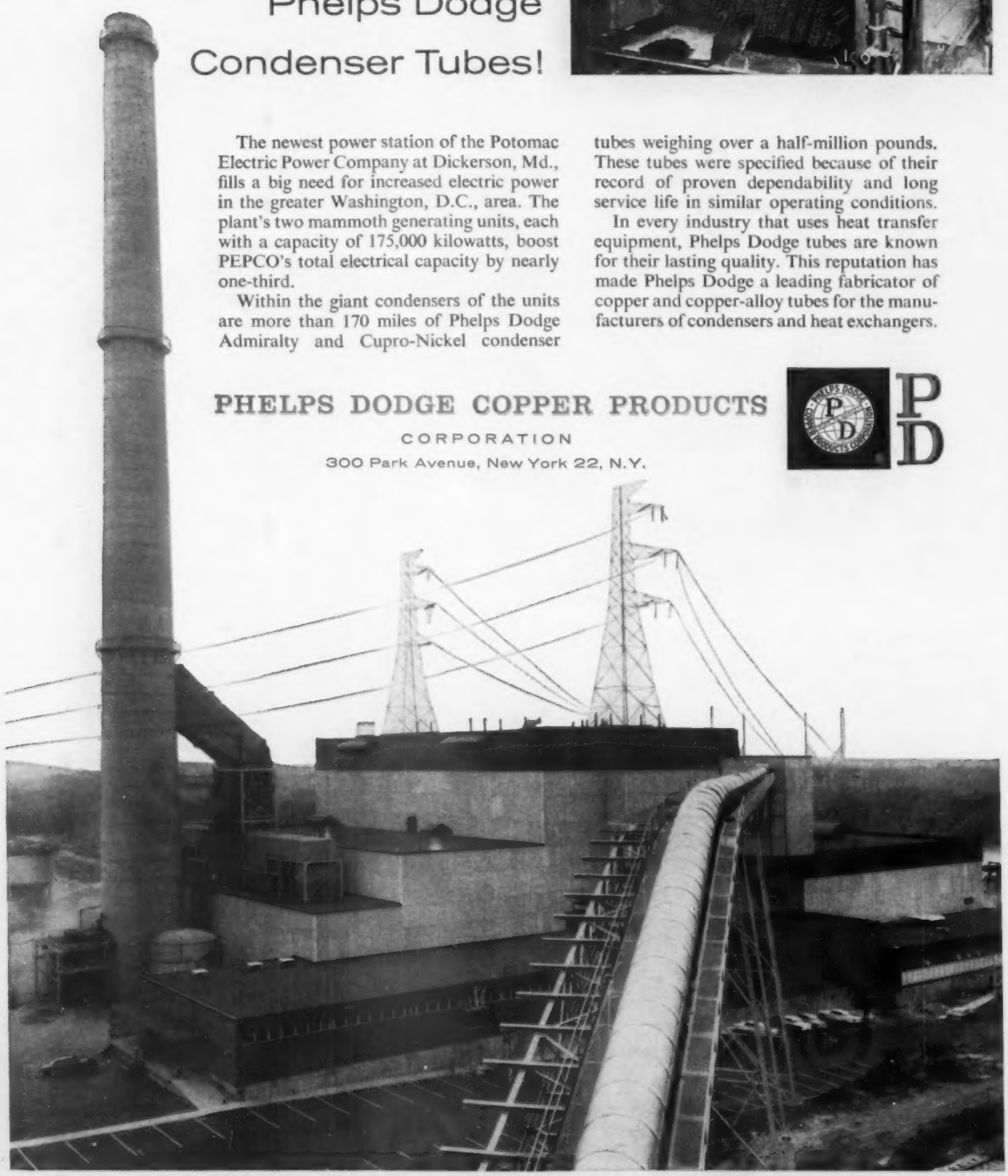


later) we are working on the wrong end of the problem.

When we say they are worthless we don't mean that they won't work. The whole trouble is: they work too well. You end up with "niusance tripping," which can be and is endured in some industries but is intolerable in others. But the purpose of this whole series of articles has been to prove that there is no excuse for nuisance tripping. It is simply the symptom of poor engineering.

"X-Ray" Gold Medallion Wiring

Again using the idea of showing the wiring behind the walls in an "X-Ray" presentation, Snake River Valley Electrical Assn. showed such a home to over 20,000 people visiting its Magic Valley Home Show in Twin Falls recently. In addition to the electrical appliances, the wiring and the heating to provide a complete Gold Medallion Home were graphically shown by this method.

Outdoor Lighting Show

Not only residential but commercial and industrial lighting for outdoor applications were shown at the 1960 Outdoor Lighting Exhibit in McKinley Park Rose Garden, Sacramento, Aug. 17-18, the first of its kind. More than 100 pieces of equipment by nine leading manufacturers representing spotlighting, floodlighting and safety lighting of outside areas such as entryways, parking lots, storage areas, parks and streets were shown. It was sponsored by the Sacramento Municipal Utility District and Sacramento Valley Electric League. The league is also sponsoring the annual Electrical Living Show, called "Electric Wonderland," at the California State Fair, Aug. 31 to Sept. 11, and housepower and modernization of home wiring will be featured there.

Hawaii IBEW Building

Local 1260, International Brotherhood of Electrical Workers, will be the second union to own its office building in Hawaii when a new $145,000, 16,700-sq-ft building, now started, is completed by the end of the year. It will contain an auditorium, kitchen, two conference rooms, a general office for the business manager and for business agents. The second floor will be devoted to rental space.

► **New Trends in Lighting** is the latest farm electrification leaflet No. 50 of the Farm Electrification Committee of University of Idaho.

Manufacturers—Distributors

► **Preformed Line Products** Co. has expanded its manufacturing plant and facilities at 600 Hansen Way, Palo Alto, Calif. The project, which cost more than $130,000, adds 16,000 sq ft and doubles the previous operating areas. According to the company announcement, the addition permits the Palo Alto manufacturing branch to duplicate almost entirely the type of production capabilities of the parent plant at Cleveland, Ohio. Planning and coordination of the Western plant is under supervision of T. F. Peterson Jr., vice-president of manufacturing, and T. F. Carter, manager of operations, in Palo Alto.

► A leased lighting plan has been announced by **Smithcraft** in conjunction with **General Electric Credit** Corp. Called Smithcraft Lease-Light, it permits owners and tenants to rent or finance modern lighting installations and construction through a lease arrangement and free their working capital for other uses. A contract is signed directly with the user, permitting him to choose his own electrical contractor. The user makes payments to the credit corporation and Smithcraft pays the distributor and contractor. The plan applies to offices, retail areas, industrial areas and schools.

► **NEMA's** Transformer Section has completed compilation of present transformer standards in one publication. Title "NEMA Standards Publication—Transformers, Regulators and Reactors: No. Tr 1-1960," the publications are available from NEMA headquarters, 155 E. 44th St., New York 17, at $1 each.

► Two new warehouses for **Westinghouse Electric Supply Co.** were opened in Portland in August. The largest, at 3265 N. W. Yeon Ave., has 15,000 sq ft of office and warehouse space. The other, housing Wesco's east side branch sales and warehouse operations, is located at 2705 S. E. Ankeny St. and occupies 5,000 sq ft.

► Acquisition of **Leadlight Fixture Co.** by **Wellmade Metal Products** Co. was announced by Edward Bergen, Wellmade president. Milton Kosman has been made sales manager of Leadlight Lighting Fixture Division with headquarters at 860 81st Ave., Oakland 21, Calif.

► **American Time Products** Inc., wholly owned subsidiary of Bulova Watch Co., has acquired exclusive rights to produce and market a line of precision automatic radiant heating controls developed by the **Harry Alfred Mulvany Laboratory** of Berkeley, Calif. According to Harry B. Henshel, Bulova president, the thermostats operate on new principles of temperature sensing and respond primarily to radiant heat energy as supplied by the electric radiant heating units in addition to effects of sunlight and changes in air temperature. The new automatic control units will be priced competitively, he said, and are installed like conventional electric heating thermostats.

► **Galvin Bros.**, electrical contractors, have moved their offices to 61 Clara St., San Francisco 7. Telephone number is EXbrook 2-2170.

J. P. Armfield (left), Portland General Electric general line foreman, and Bill Hayden (right), PGE assistant purchasing agent, check over with Clarence Bragg, vice-president, treasurer and general manager of Powerdyne Inc., one of first new pole top switches manufactured by new Portland firm for delivery to PGE

When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

For more than 50 years *Crapo* Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

Crapo Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.

For details, ask our distributor or write direct!

INDIANA
STEEL & WIRE
COMPANY, INC.
Muncie, Indiana

► **Rockbestos Wire & Cable** Co., Division of Cerro de Pasco Corp., has announced changes in sales office and warehouse locations. The Northwest territory office, under F. J. Balzer, has moved to 235 E. Third Ave., Room 205, San Mateo, Calif. The Los Angeles office, with H. G. Jones as manager, has moved to 1807 E. Olympic Blvd., Los Angeles 21. The West Coast warehouse is now at 1807 E. Olympic Blvd., Los Angeles 21.

► **Kaiser Aluminum & Chemical** Corp. closed down a potline at its Mead, Wash., reduction plant on July 23. This action was taken to adjust plant inventories of primary aluminum, according to a company spokesman. It leaves five of eight potlines operating and results in temporary layoff of about 125 workers.

► **Bailey Meter** Co. has appointed **P. B. Smith** as its Seattle manager. With the company since 1946, he had been resident engineer in the Portland office. **L. F. Monahan** is Denver district manager. He has been in Denver since 1950 and was previously resident engineer in Salt Lake City. He succeeds **A. L. Danielsen,** who has been named a regional manager.

► Appointment of **Vernon Shelters** as **Weston Instruments** Division's Repair Service & Modification Center manager at Los Angeles has been announced by Daystrom Inc. With the company for 24 years, he has been foreman in the assembly section at the Newark plant. New manager of repair service at the Redwood City plant is **Harry Chadwick,** who has been with Weston for 20 years, most recently as department head of the inspection department at Newark.

► **G-E's Insulator** Department has appointed **R. E. Bauer** to head its Portland district, which includes Washington, Oregon and northern Idaho.

► **Robert A. Upson** will represent **Stanley Electric Tools,** Division of the Stanley Works, in western Montana, southern Idaho, Oregon and southwestern Washington. He has been sales representative for the Pacific Northwest since 1954.

► **Pacific Union Metal Co.** has moved from Los Angeles to new quarters at 2320 Dominguez St., Long Beach 1, Calif. P. O. Box is 2760. Telephone is SPruce 5-1221.

► **Auth Electric** Co. has opened a district office in Los Angeles with **Harvey S. Wellman** as district sales manager. According to **E. Norman Auth,** executive vice-president, this is the first district office to be established on the West Coast under the company's current sales program. It is located at 429 S. Western Ave., Los Angeles.

Wellman

► **R. W. Beck & Associates** have opened a Southwestern region office in the Towers Bldg. at Phoenix. **Gordon D. Jorgensen,** a partner in the firm, will supervise the new office of the utility consulting firm.

► **Wiant Products** Co. has moved to 1238 N. W. Glisan St., Portland.

► **Pacific Union Metal** Co., Los Angeles manufacturer of street lighting standards, is moving into a new 43,200-sq-ft plant in Long Beach. New location is at 2320 Dominguez St.

► **Westinghouse** has redesigned its Circle W trademark and logotype. The traditional circle has been retained but dimensions have been changed and three small solid circles added to the peaks of the W.

► **Gibbons Electric** Co., Santa Clara manufacturer of power connectors, has appointed **Calrepco,** 1417 Georgia St., Los Angeles, as sales representative.

► **Carl Selby,** district representative in Portland for **Southern States Equipment** Corp., has been promoted to Western regional manager with full responsibility for commercial and engineering activities in that area.

► **George Havas** has been made vice-president and director of engineering for **Kaiser Industries** Corp. at Oakland, Calif.

► **Daystrom's Control Systems** Division has appointed **James S. Burr** sales manager in the chemical and nuclear industries and **Thomas Waldrop** in the utility field to work out of headquarters in La Jolla, Calif. **Alden H. Webber** has been appointed area representative in the West and Rocky Mountain area. His headquarters are Rt. 2, Box 34, Berthoud, Colo.

Longer Life! Superior Dependability!

THE ALLEN-BRADLEY LINE of BULLETIN 700 RELAYS IS COMPLETE!

TYPE B general purpose relay shown with 2 N.O. and 2 N.C. contacts. Made with up to 8 poles in various arrangements.

TYPE BX universal relay shown with 4 poles having both N.O. and N.C. contacts. Additional contacts on the 6 and 8 pole relays are N.O. only.

THESE IMPROVEMENTS ARE *IMPORTANT!*

These improved Bulletin 700 Type B and Type BX relays are establishing new standards for relay life and reliability. New design increases mechanical life by *at least 5 times* . . . a new contact motion insures *at least 10 times* greater electrical reliability. Double break, silver contacts never need maintenance, and the new molded coil is impervious to the most severe atmospheric conditions.

These new A-B relays—with their *extra millions of trouble free operations at no increase in price*—are a bargain in the relay field. Write for complete details, today.

NEW ENCLOSURES

for the Bulletin 700 relays are styled by Brooks Stevens—internationally famous industrial designer. Note the "family" resemblance of these enclosures.

NEMA 1

NEMA Type 1 for general purpose applications with wrap-around cover for ready accessibility. It has a "quality" appearance.

NEMA 4

NEMA Type 4 enclosure for applications that require a watertight and weatherproof seal.

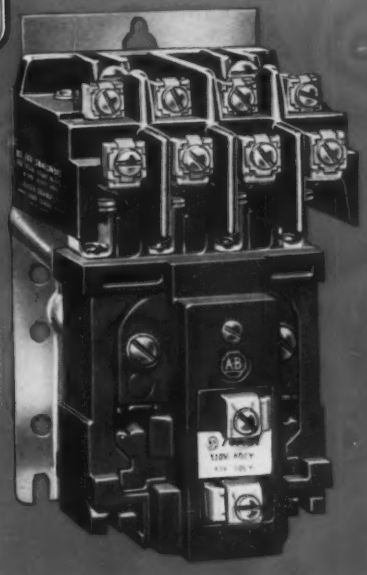
NEMA Type 7 enclosure for NEC Class 1, Group D hazardous gas locations.

NEMA 7

11-60-M

A-B QUALITY

TYPE BR Bulletin 700 convertible contact relay shown with four poles. Made with up to six poles in line.



No other relay offers such simplicity in changing contacts from N.O. to N.C. (or vice versa)—it takes only 60 seconds!

A four pole unit provides any of the contact combinations otherwise available only with five relays of the fixed contact type. You can reduce your relay inventories. In tests, this relay has *proved* it will provide many millions of trouble free operations. Double break, silver contacts never need servicing. Also, each relay can have one or two complete and full rated contacts added to its base—in the field—without increasing space requirements. If you don't know about the Type BR relay, let's get acquainted.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley, Canada Ltd., Galt, Ontario

QUALITY MOTOR CONTROL

ALLEN-BRADLEY

Quality Control Centers

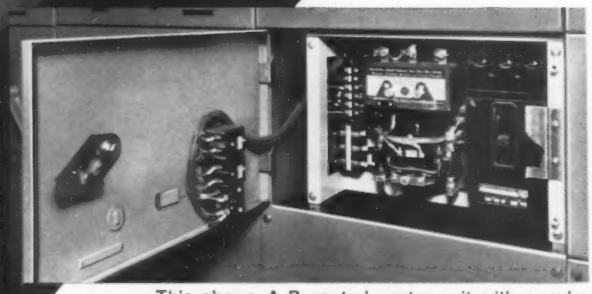
...the mark of a modern plant providing the utmost in reliability, safety, convenience, and lasting beauty

The superior *quality* of Allen-Bradley control centers provides a modern and attractive installation —one that you'll be justly proud to have in your plant. The cost is commensurate with the quality of the workmanship—but you'll never have reason to regret your decision. Furthermore, Allen-Bradley control centers arrive completely wired and tested —and *installed* costs are usually substantially lower than that of individual starters.

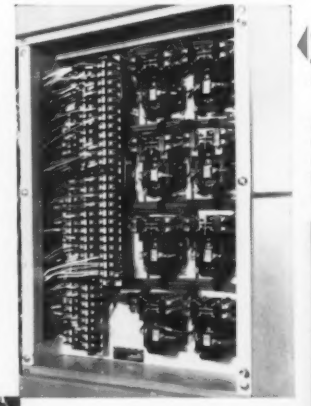
The flexibility of A-B control centers makes them readily adaptable to changing needs. Individual units can be added or modified without internal rewiring. In addition, entire sections can be added to meet future plant expansion.

For the finest in control centers, you cannot surpass Allen-Bradley's Bulletin 798. Write today.

Allen-Bradley Bulletin 798 Multi-Unit Control Center

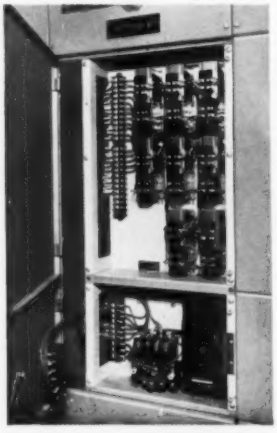


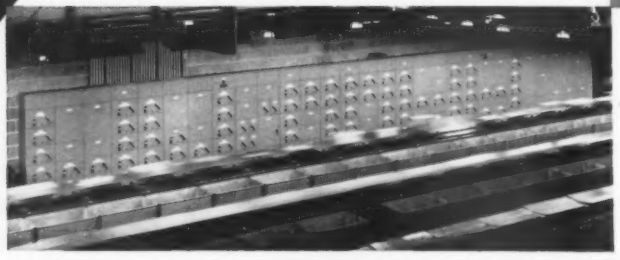
This shows A-B control center unit with popular A-B Bulletin 709 solenoid starter and circuit breaker.



This shows A-B Bulletin 700 control relays mounted in an A-B control center unit.

A-B control centers can be equipped with a wide variety of components. These Bulletin 849 timers are used on an automatic conveyor line.





This huge, 48-foot A-B control center houses 101 A-B Bulletin 709 solenoid motor starters. It is designed to permit an addition containing 50 more Bulletin 709 starters.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

► **Edwards Co.** has announced a simplified unit pricing program designed to save distributors time and money. Products now fall into two categories: Class I, covering stock items and some components; Class II, systems. Price lists have been revised and are now color-coded. Electronic data processing systems at Norwalk headquarters have been integrated in the system to speed up invoicing. Part of the line has been repackaged with fast-moving items in multiple and slow-moving products packed singly. Under a change in shipping policies, the company will pay transportation costs within continental United States on all orders above $200. Distributors get a 5% bonus in case of incorrect shipment.

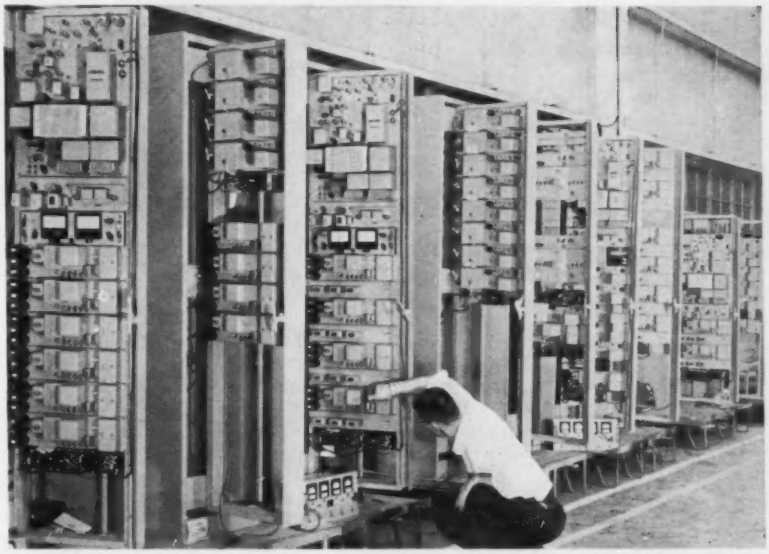
► **Fred Goss,** president, **Electric Supplies Distributing** Co., San Diego, corrects us that instead of seven houses in that company chain there are now eleven. They are in San Diego, headquarters; Arcadia; Anaheim; Santa Ana; Long Beach; El Centro; El Cajon; Escondido; and Pasadena, Calif.; and in Phoenix and Tucson, Ariz. They are all individual corporations and subsidiaries of the main house in San Diego.

► **The Epoxylite** Corp. is building and will soon move into a new plant and laboratory building completely air conditioned and accurately air controlled on Tyler Street in El Monte from its present location at 10829 E. Central Ave. of the same city, according to **L. J. Rejda,** president. Half of the new 10,000-sq-ft building will be devoted to laboratory, the remainder to plant. The company specializes in preparation of epoxy materials used in the motor insulation field.

► **Alwalt Mfg.** Co. at Modesto was host to a large group of members of the Sacramento Valley Chapter NECA and to electrical inspectors of the area on July 14. The tour left Sacramento at 3 p.m. after a business meeting and consisted of a tour of the new offices, warehouses and manufacturing areas of the company's new plant. They were guests at a chuckwagon-style dinner provided by R. A. Johnson, president, and Henry Christian, vice-president and general manager of the company.

► First unit of a 75,000-sq-ft plant for the newly incorporated **Custom Systems Corp.** is nearing completion at Santa Ana, Calif. The firm makes electrical cable systems.

Carrier System for San Francisco



The City of San Francisco is installing a 30-channel power line carrier current system for the new Hetch Hetchy hydrogenerating project in the Sierra Nevada incorporating the latest trends in power control automation. It is the largest carrier-current shipment made by General Electric in its 38 years in the carrier-current field

► **William T. Kennedy** broke ground in South San Francisco's Airport Boulevard Industrial Park for a new building to house Kennedy Electric Co. The industrial and commercial electrical contractor expects to move into the new and larger facilities, embracing 10,000 sq ft, on Aug. 1. Former location was at 6237 Mission St., Daly City. Kennedy has long been active in the San Francisco and Peninsula electrical contractors' associations.

► **Benjamin Reel Products** has named **Shields, Harper** & Co. warehouse distributor for the Western states. Warehouses are located in Oakland, Los Angeles, Portland and Seattle.

► **Line Material Industries** is running a three months' V-for-Vote student essay contest for children of its employees, according to **Paul K.** Churchill, West Coast regional manager. Children (grades 7 through 12) are eligible to enter the contest entitled "Why Your Country is Counting on Your Vote."

► **John Carder Jr.** Co. has been made sales representative for the new aluminum rigid conduit made by **Harvey Aluminum** at Torrance, Calif. Offices are at 1624 First St., N. W., Albuquerque, and 1415 S. Main St., Salt Lake City. The territory will cover the States of New Mexico and Utah and El Paso, Texas.

► **G-E's Computer Department** is installing a million dollar data-processing system at its Computer Center at Arizona State University in Tempe. The new transistorized system, 304, will replace equipment installed in 1957 and will increase facilities available to the university and to local and regional organizations.

► **R. S. Hughes** Co. of Los Angeles has been appointed exclusive distributor in the 11 Western states for Teflon cables, manufactured by **Philadelphia Insulated Wire** Co. Hughes' headquarters are at 4515 Alger St., Los Angeles 39. Warehouses are maintained in San Francisco, Palo Alto, San Diego and Denver.

► **Southwest Wholesale Electrical Supply Inc.** recently moved to a new location in San Diego at 4600 Santa Fe St., Pacific Beach.

► **Spartus** Corp. has named MacLaurin-Bendik & Associates, 1300 Cherokee St., Denver, as factory representative in the Rocky Mountain area. J. C. MacLaurin and Frank Bendik will cover the states of Colorado, Wyoming, Utah, Montana and eastern Idaho.

► Merger of **American Pulley** Co. and its **Hubbard Spool** Division into **Van Norman Industries** has been completed under a stock exchange plan.

*Trademark

"Superforms* help me keep lines in service"
...DISTRIBUTION ENGINEER

"To me, the word 'Superformed' means a number of plus values:

"*Service continuity* to keep our customers satisfied . . . *low maintenance costs* . . . in short, *greater dependability* and *savings*."

Everywhere, Distribution Engineers . . . *the men technically responsible for keeping customer lines in service* . . . acclaim Fanner Superforms. A-1586A

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"PROTECTIVE TWIST"

ARMOR RODS...
Protect long-span T&D lines at supports

LINEGUARDS...
Protect short-span T&D lines at supports

PATCH RODS...
Repair damaged conductors

TAP ARMOR...
Protects conductor at tapping points

FANNGRIPS...
For dead-ending strands and conductors

FANNSPLICES...
Join two ends of conductor wire

PLASTIC PRODUCTS...
For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

Price Reductions

Price reductions up to 5% on pole type distribution transformers have been announced by General Electric Co., which estimates that savings to electric utilities could total more than $10 million annually.

The new prices reflect market trends and a tendency toward fewer standard kva ratings. Prices are reduced from 1% to 5% on pole-type distribution transformers rated 10, 25, 50 and 100 kva. Prices on other sizes are essentially unchanged.

The preferred series of kva ratings was selected for price reduction as a result of a special survey made recently among a cross section of the nation's electric utilities, the manufacturer said. The manufacturing cost savings, realized from utility support in volume purchases of fewer kva ratings, enabled the company to reduce the price of those kva sizes on which the majority of utilities reported they would standardize.

► **NEMA's** Second Electric House Heating Symposium and Exposition, an expanded version of the 1960 program, will be held March 19-21, 1962, in the Sherman Hotel at Chicago.

NEMA is making available proceedings of the first symposium in a 232-page book compiled by the Electric House Heating Equipment Section. These proceedings sell for $5 a single copy with quantity discounts. The section is also offering bumper stickers in white and red on a black background with the message "You Can't Beat Electric Heat." The adhesive-backed stickers sell for $8 for 100. Both items may be ordered from R. D. Smith, secretary, Consumer Products Division, National Electrical Manufacturers Assn., 155 E. 44th St., New York 17.

► **W. W. Smith** is now manager of the California plant of **General Electric's Distribution Assemblies** Department. Prior to this appointment, he was manager of commercial engineering at that plant.

► **Temtrol Division of Penn Controls** has built a new plant at Costa Mesa, Calif. The division makes controls for appliances, heating and industrial applications. Address is P. O. Box 553, 2930 College St., Costa Mesa, Calif.

► **Federal Pacific Electric** Co. will acquire **Pioneer Electric** Ltd., Canadian electrical equipment manufacturer, for approximately $5 million in cash and stock.

► **Lockheed Aircraft** Co. is investigating the commercial potential of plastic products for heating, ventilating and lighting fixtures. It has moved into a new $3 million plastics plant in Burbank.

► **Multi-Amp** has appointed **Wrathall & Krusi,** 681 Market St., San Francisco, as its representative in northern California and most of Nevada.

► A guarantee of 12% higher loading for pole-type distribution transformers has been announced by **Pennsylvania Transformer Division, McGraw-Edison** Co. According to the company, the increased capacity, at 65 C rise, will not affect transformer life. Transformers through 100 kva, 18 kv and below, are included.

► Ratings of its transformers, 5 through 10,000 kva, will be increased 12%, according to **Kuhlman Electric.** A transformer rated 25 kva will give 25 kva at 55° temperature rise and 28 kva at 65° rise with no sacrifice in transformer life, the manufacturer states. Uprating will apply to both self-cooled and forced-air-cooled ratings of medium power transformers.

► Because of widening diversification, **McGraw-Edison** Co. has renamed its Coolerator Division the **Albion Division.**

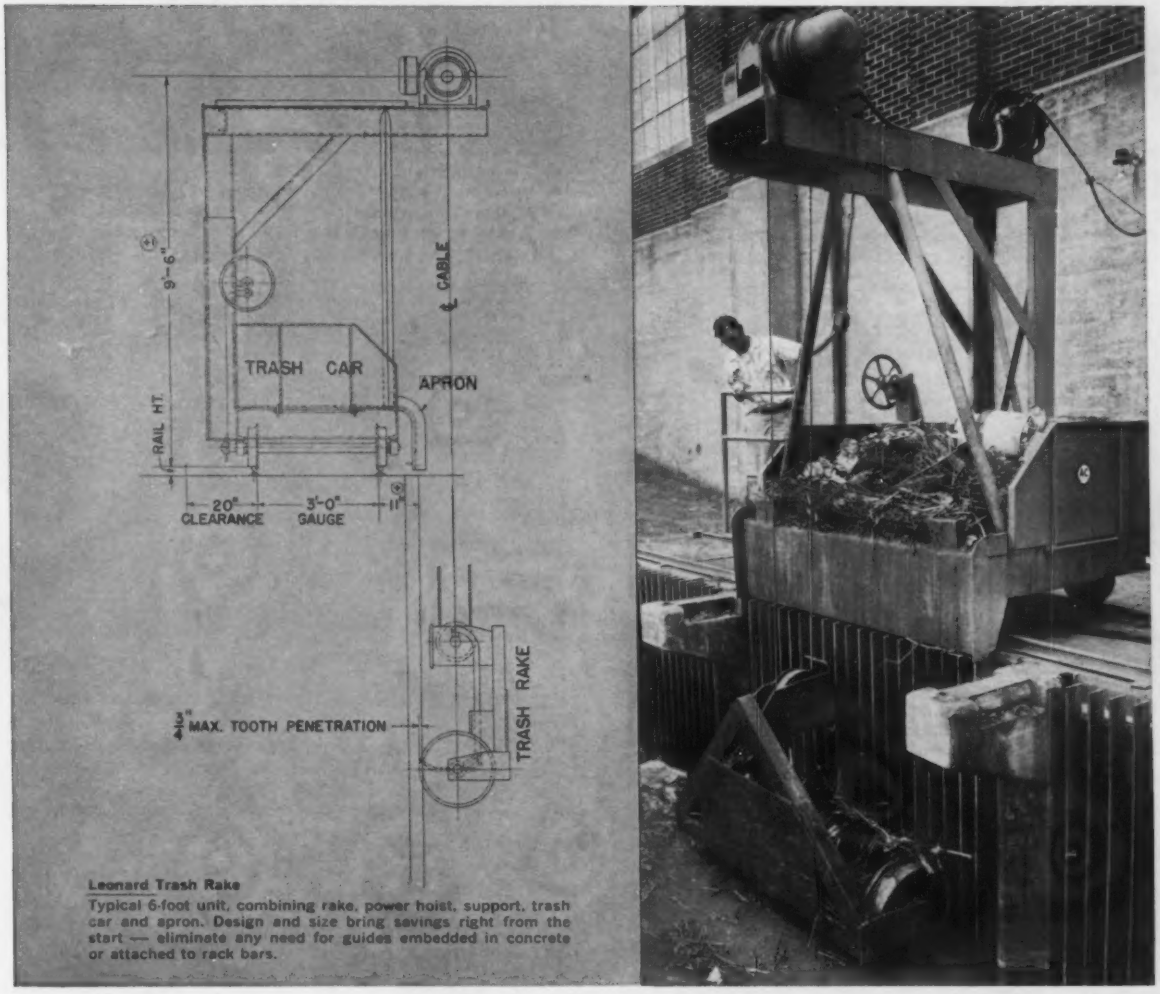
► **Production of super purity** aluminum is being tripled at **Kaiser's** Mead, Wash., reduction plant with the installation of six new refining cells, the company announced last month. Construction of the cells, which will have an annual rated capacity of 360,000 lb each, is under way and production is expected to begin in September.

► **Moloney Electric Co.** has announced introduction of a new high temperature insulating paper, Duratherm, in distribution transformers. Basic design has not been changed and high temperature oil will not be required, the company stated.

► **G-E** has opened a new Gear Motor Center in San Francisco to serve 11 Western states. **Glenn D. Tobias** has been appointed Western regional sales manager of the new center which is located at 1098 Harrison St. H. L. Olmstead is manufacturing supervisor.

► **Henry J. Kaiser** Co.'s Heavy Construction Division has been renamed Kaiser Engineers International Division.

ALLIS-CHALMERS



Leonard Trash Rake
Typical 6-foot unit, combining rake, power hoist, support, trash car and apron. Design and size bring savings right from the start — eliminate any need for guides embedded in concrete or attached to rack bars.

Cleans up costly head losses

. . . rakes-in savings enough to pay for itself!

Here's intake-trash removal so far ahead of hand methods that *"once sold is sold forever!" Leonard* trash rake installations deliver savings both in reduced head loss and labor costs. And they bring a permanent solution to shortages of people to do the job — make trash removal a one-man operation.

Leonard trash rakes roll right down your existing rack bars whether vertical or inclined. Because no channel guides are needed, they freely ride over stubborn obstructions, dig them loose, scoop trash up to the waiting receptacle or car. Self-dumping units also are available—both log-grapple and regular models.

With Allis-Chalmers trash rakes even the initial investment is low. Width is held to the logical minimum required for adequate handling of trash . . . standard 6- and 8-foot sizes. Larger units special. Your nearby A-C representative has full details. Or write **Allis-Chalmers,** Hydraulic Division, York, Pa.

Leonard is an Allis-Chalmers trademark. A-1307

For phone number of closest representative see advertising index in back of book.

1 I'm H. G. Millican, President of Millican Electric Company, Atlanta, Georgia. The people at SPANG asked me for my opinion of SPANG Conduit Couplings. We've used them for years—almost exclusively—on electrical jobs in our area, and there are a number of reasons why.

2 Most important from an installation viewpoint is the fact that the conduit will butt in the coupling—not just most of the time, but always. This butted joint leaves no slot for the snake wire to catch in. Makes wire pulling smooth. No time lost trying to unsnag hook ends.

3 SPANG quality is invariably high. Threads are clean and uniform—no burrs or snags to bind the conduit. In fact, you can run couplings on the conduit by hand. Practically a machine fit. Try it and see! It means the coupling is straight. This is another time-saver on the job.

4 SPANG Couplings are *double*-galvanized. First the conduit stock is hot-dipped — then the finished coupling is electro-galvanized. Now this means there is no metal-to-metal contact of coupling and conduit. No galvanic action. Instead, it forms a strong, watertight, permanent joint for excellent wiring protection.

5 Here's something else: the handy packaging SPANG uses for both its couplings and elbows. They're well-marked, easy to locate in storage and a snap to inventory. You know, the SPANG people say nobody produces a better coupling than they do. Know something else? They're right!

This is what one leading electrical contractor says about Spang Conduit Couplings

Thank you, Mr. Millican, for your comments on SPANG Conduit Couplings. Thousands of other electrical contractors share your enthusiasm for this top-quality SPANG electrical product.

The same top quality is the hallmark of all SPANG Conduit Products — SPANG HD Galvanized Conduit, SPANG Black Conduit, SPANGLEAM EMT and the new SPANG Rigid Aluminum Conduit. Your nearby SPANG Distributor carries the complete line. Call him for top-quality service!

SPANG CONDUIT

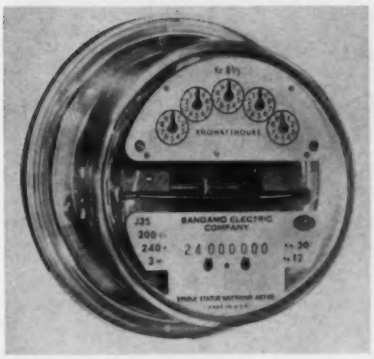
THE NATIONAL SUPPLY COMPANY

One Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation

PRODUCT NEWS

New Designs and Applications



Meter

(1) *Sangamo Electric Co., Springfield, Ill.*

A new watt-hour meter, type J3, has a magnetic flotation system supporting the moving element, said to practically eliminate friction and wear. Two cylindrical Alnico magnets, with opposing magnetic fields, float the rotating element on frictionless lines of magnetic flux, the manufacturer states. This magnetic cushion, combined with upper and lower cobenium pivots and graphite rings that guide the element, holds the disk accurately in position even when the meter is installed at considerable degrees of tip or tilt, the manufacturer states.

Upper and lower endshake is controlled by Delrin thrust plates. Epoxy-coated current coils provide improved insulation level and better heat dissipation. Even repeated surges at 2,000 amp through current coils and of 20,000 amp through neutral wire will not alter registration beyond allowable limits of Standard MSJ10.

Potential coil is encased in an acetate sheet to provide 10-kv rms insulation level and a safety factor in respect to the arc-gap flash-over value of 4,500 v. Potential coil characteristics of a three-wire, 240-v J3 are such that it may be used on two-wire, 120-v service, the manufacturer states.

Floodlight

(2) *Wide-Lite Corp., Box* 191, *Houston, Tex.*

This company announces a new floodlight with a vertical beam spread of only 8°, and a horizontal beam spread of 100°. The new Wide-Lite Lumitor floodlight uses the remarkable new quartz-iodine lamps, which do not grow dim during their long lifetime.

The quartz-iodine lamp life is conservatively rated at 2,000 hours, as compared with 1,000 hours for an ordinary incandescent lamp. It has a mean efficiency of 22 lumens throughout its life, while an ordinary incandescent lamp has a mean efficiency of 14.5 lumens per watt. These remarkable gains in lamp life and mean efficiency are obtained because the traces of iodine gas in the lamp catch the particles of tungsten that evaporate from the hot filament, and return them to the filament. As a result, the tungsten particles are not deposited on the inner surface of the glass wall, as in ordinary lamps. The glass wall does not darken, and thus reduce lamp efficiency. Filament life is more than doubled.

Plastic Refractor

(3) *General Electric Co.,* 1 *River Rd., Schenectady* 5, *N. Y.*

General Electric's new acrylic-suburban luminaire for mercury vapor lamps up to 250 w and filament lamps up to 6,000 lumens features a virtually unbreakable plastic refractor. BB pellets and rocks will bounce off; .22 bullets will penetrate but not shatter the refractor, according to the manufacturer.

Weatherproof Lamp Holder

(4) *Killark Electric Mfg. Co.,* 3940 *Easton Ave., St. Louis* 13, *Mo.*

A new, all-weather holder designed to accommodate PAR-64 500-w lamps is said to provide trouble-free operation under the most severe conditions. Designated the SSNB series, this holder has a ¾-in. thread on the base of the knuckle mounting, which is notched to prevent loosening when the holder is used in high-vibration areas.

Lightning Arrester

(5) *Joslyn Mfg. & Supply Co.,* 155 *N. Wacker Dr., Chicago* 6, *Ill.*

This line of distribution valve arresters from 3 to 18 kv utilizes a series of short quench and isolating gaps in unit structures with electrostatic shielding to secure low impulse sparkover. A Micro-Pack valve element of silicon carbide is said to insure high thermal capacity and low discharge voltage characteristics. Direct-connected types are available with either stud connectors or insulated line leads, both with automatic ground lead disconnectors.

ALLIS-CHALMERS

"Originators of 5/8% Step Regulators"

Caliband is an Allis-Chalmers trademark.

Lower! Lighter! Perfect for joint-pole use

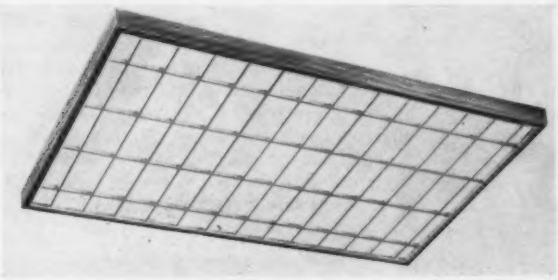
new JFR regulators cut installation costs

CALIBAND control slashes setting time without changing customer voltage or interrupting service! A twist of the knob and you set or test voltage level and band width. No need to return compensator settings to zero.

Allis-Chalmers all-new JFR is the top qualifier for joint-pole use . . . pad or platform mounting. Tank size and weight reduced up to 33%, due to JFR's improved materials and design techniques. Naturally, you save on transportation, handling and installation.

More new JFR advantages! Now offered as *standard*, position indicator drag hands reset by pushbutton on the control panel. A new, quick-sight gauge instantly reveals oil level. Exclusive unidirectional breather removes all moisture and contaminating gases. And a new cover, with hidden bushing mounting studs, cuts maintenance. *For all the facts ask your nearby A-C office for new JFR Bulletin 21B7977E or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.* A-1261

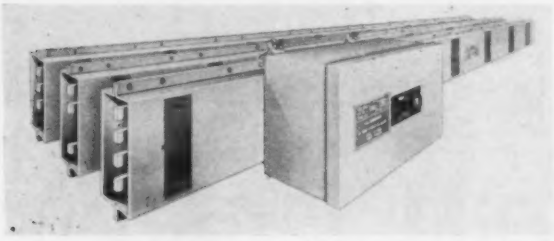
For phone number of closest representative see advertising index in back of book.



Decorative Fluorescent

(6) *Lightolier Inc., 346 Claremont Ave., Jersey City, N. J.*

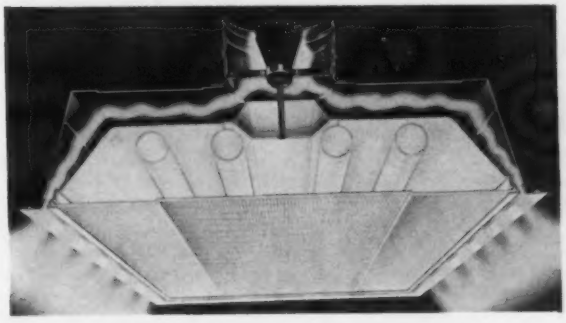
An entirely new concept in a decorative and functional fluorescent ceiling fixture, called Corona, has just been introduced by Lightolier. Its fresh new qualities of appearance, lighting function and scale have hitherto been available only in custom lighting, according to the manufacturer.



100-Amp Busway

(7) *H. K. Porter Co. Inc., National Electric Division, Porter Bldg., Pittsburgh, Pa.*

A new 100-amp busway made by this company is designed for electric lighting and power distribution in commercial, institutional and industrial buildings. Trade-named Speedbus, it is made in preassambled sections of packaged 5- and 10-ft lengths ready to install with simple hand tools.

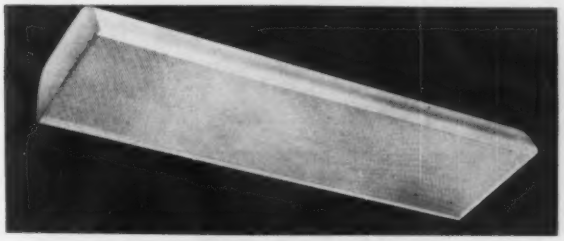


Light and Air Diffuser

(8) *Day-Brite Lighting Inc., 6260 N. Broadway St., St Louis 15, Mo.*

Day-Brite Lighting Inc., and Barber-Coleman Co. announce a complete line of combination lighting and air diffusing equipment, developed through the combined research facilities of the two companies. The new units are described as "the successful blending of two prime comfort factors, which provide the much needed solution to a growing problem in interior design . . . the competition between acoustical material, air distribution and lighting elements."

The dual purpose units are available in both 12x48-in. and 24x48-in. sizes, with a wide choice of lighting enclosures including louvers, plastic and glass.

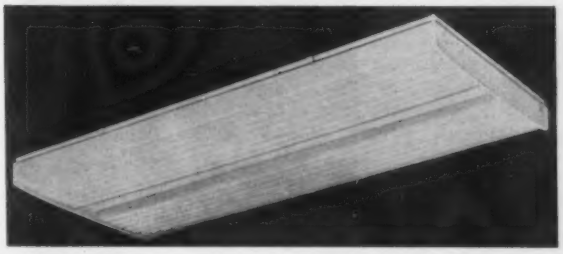


Fluorescent Luminaire

(9) *Lighting Products Inc., Highland Park, Ill.*

Lighting Products announces a new line of Trend series fluorescent luminaires specially designed to provide high-level illumination for schools and offices, at recommended standards for visual comfort.

Design of the new luminaires includes attractive, completely luminous wrap-around side panels. Together with efficient diffusers, the design results in higher foot-candle levels than provided by conventional fixtures, with greater visual comfort.



Indoor Luminaire

(10) *Holophane Co. Inc., 342 Madison Ave., New York 17, N. Y.*

The new 6000 series luminaire featuring Holophane crystal clear, acrylic, prismatic Controlens has been announced by this company.

The 6000 series is only 3 13/32 in. deep to ceiling line. Each of the two lenses is made of one, single injection molded piece 4 ft long.

Its distinctively clean, shallow appearance integrates with a wide variety of modern interiors combining economy, visual comfort and high efficiency.

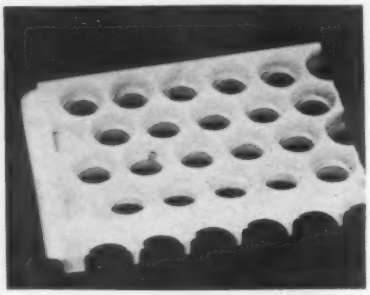
For More Product Information Fill in Coupon on Page 121

Bonus Mercury Lamp

(11) *General Electric Co., Nela Park, Cleveland* 12, *Ohio*

The large lamp department of the General Electric Co. announces a complete line of improved mercury vapor lamps from 100 to 1,000 w.

The manufacturer states that these new lights will give approximately 50% more light at 6,000 hours than the old line of lamps. Priced approximately the same as the old-type lamp, the useful life is said to be double.



Luminous Ceiling

(12) *Cirvac Plastics, Erie, Pa.*

A new type of rigid vinyl luminous ceiling material combining exceptionally high light transmission qualities with even diffusion has been selected to meet the critical lighting requirements of the gage control room of General Electric's ordnance department plant in Pittsfield, Mass.

Circlgrid panels are made by vacuum-forming translucent vinyl sheets to provide closely spaced circular depressions. Two of these sheets, with the circular depressions fitted back to back, are then electronically bonded in sandwich fashion and are furnished in the standard 23¾x23¾ in. and 23¾x47¾ in. panels.

Outdoor Fluorescent Lamps

(13) *General Electric Co., Nela Park, Cleveland* 12, *Ohio*

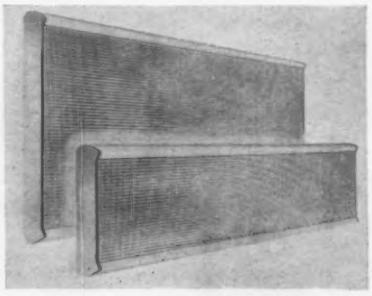
Extension of the line of outdoor fluorescent lamps to include 4-, 6- and 8-ft types has been announced by the General Electric Co.'s large lamp department.

These fluorescent lamps, previously available in 8-ft lengths only, were developed to overcome the loss of light output in other fluorescent types when exposed to severe low temperatures.

Outdoor Post

(14) *Virden Lighting, 5209 Euclid Ave., Cleveland* 3, *Ohio*

Now available from Virden Lighting is a new outdoor post made of a new material called Kralon. This material is said to offer many advantages at a cost less than posts made of other materials. It will not rust, rot; never needs painting. And, because Kralon will not conduct electricity, posts are safer. Further, this material does not become brittle in freezing temperatures. At -20 F, this post withstood a blow of an 8-lb sledge and a 38-caliber bullet without shattering. Available now in standard 3 in. diameter size 84 in. long, black finish.



Luminaire

(15) *Sunbeam Lighting Co., 777 E. 14th Place, Los Angeles* 21, *Calif.*

This new luminaire series with Sunlux lens panel is a fully enclosed, all-plastic shielded wafer-thin Visionaire designed primarily for surface mounting. According to the manufacturer, the soft glow from its wraparound plastic enclosure complements any interior and modernizes it. Translucent white plastic side panels are interlocked with clear, optically sharp Sunlux bottom panel forming a single diffusing element. The plastic enclosure is sturdily framed in metal and may be opened from either side without tools on concealed full-length hook-on hinges. The luminaire is QPCX7400 series and is available for two- and four-lamp rapid start operation.

Pole Top Luminaire

(16) *Line Material Industries 700 W. Michigan, Milwaukee* 1, *Wis.*

New internally ballasted pole top luminaires, designated Line 2E2, are designed for high-level lighting of streets, highways and parking areas. A permanent-mold cast aluminum base encases ballast, terminal block and collet-type clamps for attaching luminaire to steel or aluminum poles.

Improved Mercury Arc

(17) *Westinghouse Electric Corp., Bloomfield, N. J.*

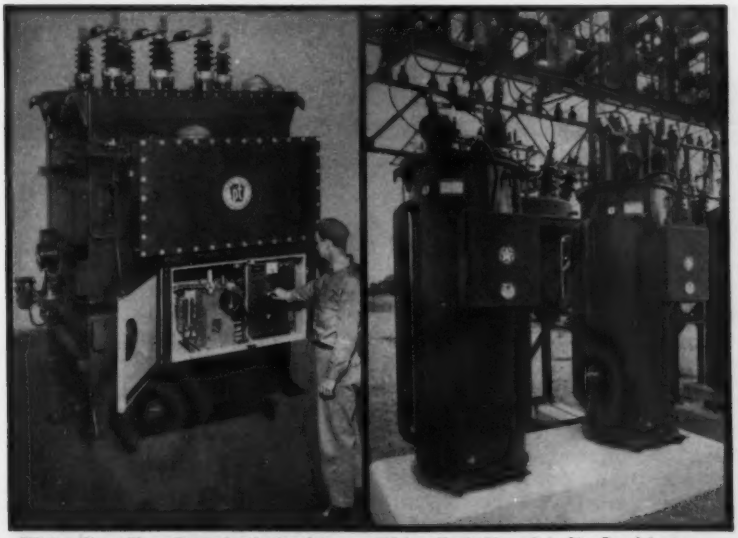
Westinghouse announces a major improvement in lamp construction.

Originally incorporated in 400-w mercury vapor lamps, a new Lifeguard arc tube containing an electrode that drastically reduces the blackening of the arc tube during the life of the lamp will now be used in 175-, 250-, 425-, 700- and 1,000-w mercury lamps. According the Gordon W. Howson, Westinghouse Lamp Division lamp marketing manager, the new arc tube provides the customer with up to 20% additional light throughout the life of the lamp. Lamps with the new construction have a rating of over 40% longer useful life.

in both single- and three-phase regulators...

CONTROLLED SPEED of Pennsylvania Direct-Drive Tap Changer gives you

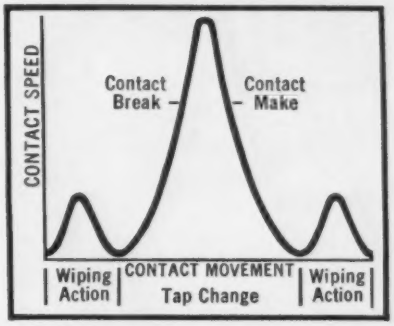
- **MINIMUM CONTACT EROSION**
- **QUIET OPERATION WITHOUT MECHANICAL SHOCK**
- **LONG-RANGE UNIFORMITY OF OPERATION**



750-kva Three-Phase Pennsylvania Regulator 125-kva Single-Phase Pole Star Regulators

Recent introduction of Pennsylvania's single-phase Pole Star Regulator means that utilities can now obtain 32-step regulation with a direct-drive tap changer in *both* single- and three-phase step voltage regulators.

The following curve illustrates some of the principal advantages of Pennsylvania's direct-drive mechanism:



Both the speed and movement of the contacts are carefully controlled by means of scroll-cam, geneva-gear operation. First, a preliminary wiping movement positions the contacts for the tap change. The contact *break* then occurs during *rapid acceleration* . . . but an equally rapid *deceleration* occurs before the contacts are re-engaged. After a momentary pause, contacts move to their final position with a slow wiping action that has a self-cleaning effect.

This controlled speed minimizes arcing at both ends of the tap change . . . particularly at completion of the tap change, where the slower speed *eliminates arc-producing contact bounce*. Reduced arcing has the double effect of lessening both contact erosion and oil deterioration.

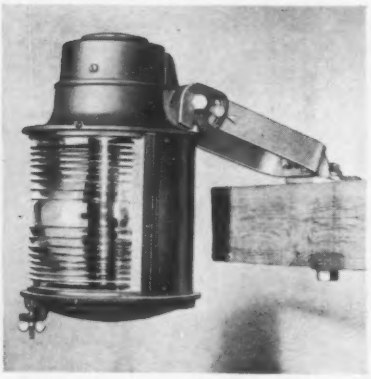
Other advantages of the direct-drive tap changer include *long-range uniformity* of speed and positioning, and *quiet operation, without mechanical shock*.

Want to arrange a demonstration?

If you have not already done so, why not personally inspect Pennsylvania's direct-drive tap changer? Demonstrations for engineering and purchasing personnel can be arranged by writing to Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

Pennsylvania Step Voltage Regulators

For phone number of closest representative see advertising index in back of book.



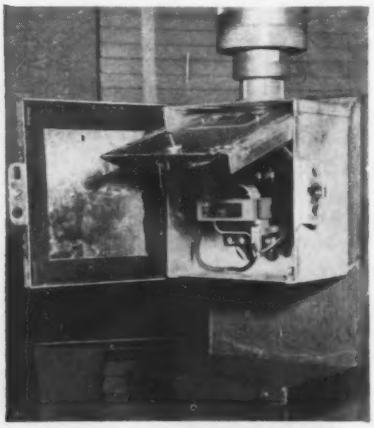
Fence Light

(18) *Crouse-Hinds Co., Wolf and 7th North St., Syracuse 1, N. Y.*

For protection of property and increased plant security, this company announces the introduction of its PLB Fresnel floodlights. Combining a wide horizontal beam sprayed with narrow vertical beams, these lights are said to provide a band of light completely around an area, to discourage intruders.

Widely used for fence lighting, each floodlight is mounted on a pole approximately 30 ft from the fence.

For economical operation, type PLB can be furnished for use on either multiple or series circuits, and for crossarm or pipe mounting.



Contactor for Highway Lighting

(19) *General Electric Co., Schenectady 5, N. Y.*

An auxiliary contactor for street and highway lighting has been designed by this company to meet the latest specifications of the Division of Highways, State of California, for use in conjunction with light-actuated control devices to provide either single- or multiple-circuit control of street or highway illumination.

The enclosure is raintight and dusttight, galvanized, deadfront, with a hinged and gasketed cover.

The contactor is rated 35 amp, maximum, for tungsten, fluorescent or mercury load.

Light Control Lens

(20) *Leadlight Division, Wellmade Metal Products Co., 860 81st Ave., Oakland 21, Calif.*

This company announces a new Prismacon light control prismatic lens that achieves the high-light levels and low-brightness features long associated with only expensive acrylic lens.

Applications for the new Prismacon prismatic lens are not limited to new installations, such as office buildings, schools, etc., but also for replacing ordinary low cost vinyl diffusers, allowing for 40% higher light levels at no appreciable increase in cost.

Vinyl Ceiling

(21) *Contrex Co., Chelsea, Mass.*

A rigid vinyl sheeting that provides light diffusion and balanced sound absorption has been developed for over-all ceiling lighting systems.

Introduction of the product, called Soundsheet, by its manufacturer, provides a solution to a problem that has plagued architects for many years—how to provide acoustical control in rooms where over-all ceiling lighting systems are to be used.

Adaptable to most existing over-all lighting equipment, Soundsheet consists of a vinyl sheet perforated with tiny holes. To both sides of this sheet is laminated a thin layer of paper saturated with Geon vinyl latex, a product of B. F. Goodrich Chemical Co. This latex is said to be effective for saturating and bonding the paper to the vinyl sheet because it imparts dimensional stability and tear strength to the paper and adds to the vinyl sheet's flame resistance and stability to light exposure.

Fluorescent Fixture Tester

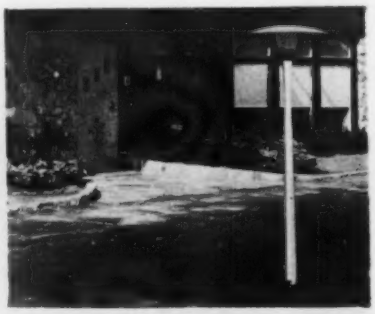
(22) *Supro Lux Mfg. Co. Inc., 406 E. 161st St., Bronx 51, N. Y.*

This company introduces a new tester for testing fluorescent fixtures and plastic electric signs. This tester is for use in testing high output, very high output and power groove fluorescent fixtures, and will indicate the condition of the ballast and its associated wiring.

Converter

(23) *Precision Multiple Controls Inc., 233 Chestnut St., Ridgewood, N. J.*

Convertalume is introduced as a low cost, lightweight ballast unit that converts any NEMA standard incandescent fixture to mercury in one minute. Conversion is accomplished by inserting the unit in any locking-type receptacle designed to NEMA standards.



Lighting Post

(24) *Pfaff & Kendall, Residential Lighting Division, 84 Foundry St., Newark 5, N. J.*

This all-aluminum residential lighting post was designed for use with the Holophane 431 luminaire. According to the manufacturer, the post is made of the same high-strength aluminum alloy that is used in street and highway lighting standards.

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4 / 6—1 0 A A R Cu. 8—1 0

BLACKBURN COPPER TO ALUMINUM FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION
1525 WOODSON RD., ST. LOUIS 14, MO.
WYdown 3-9430

For phone number of closest representative see advertising index in back of book.

It took 29 yrs. research to make

JAQUES hydraulic HOLE DIGGERS

Fastest, Strongest, Safest most economical!

Jaques TJ-254 digging at 30 degree angle. Operates at up to 45 degrees.

-----FREE---

TEXOMA ENTERPRISES, INC.
HIGHWAY 75 North, SHERMAN, TEXAS

☐ Send me FREE detailed literature.
☐ Have representative call. No Obligation.

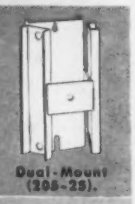
NAME_____
TITLE_____
ADDRESS_____
CITY_____
STATE_____

Time-and-money-saving features of Jaques All-Hydraulic Hole Diggers took 29 years to develop. Rugged, versatile Jaques TJ-254 mounts on standard trucks, drills holes up to 48" diameter, to 25' depth, in hardest soil or rock — FASTER, CHEAPER, EASIER than competitive machines! Fewer moving parts insures ***minimum downtime, maintenance, operating costs.*** Shock-resistant device relieves strain in rock digging. Simple to operate with only 3 primary adjustments. FREE DEMONSTRATION WILL PROVE THESE CLAIMS!!

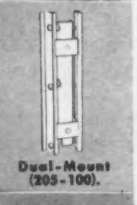
TEXOMA ENTERPRISES, INC.
HIGHWAY 75 NORTH • SHERMAN, TEXAS

Cluster Mount Transformers Quickly . . . Easily . . . Securely . . . with

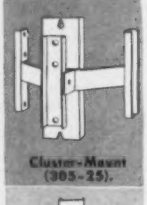
Cluster-Mount (305-100).



Dual-Mount (205-25).



Dual-Mount (205-100).



Cluster-Mount (305-25).

Cluster Heavy-Duty Mount (350-167).

TECO thru-bolt Mounting Brackets

Cluster mounting two or more transformers is no problem with TECO thru-bolt cluster mounting brackets.

Transformers can be bolted to brackets with majority of connections made on ground and then hoisted into place—all in half the time required to install a band-type cluster rack.

When you consider cluster transformer mounting brackets, remember that TECO offers you;

Safer, more secure installation with thru-bolt mountings. Brackets are of hot galvanized one-piece welded construction. Key hole and slots provide ease of installation. All TECO brackets have a two to one safety factor.

No parts to lose—no complicated assembly.

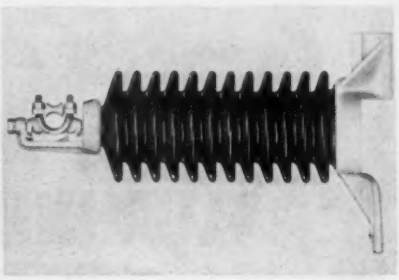
Safety for linemen. Plastic cap over head of bolt eliminates possibility of ground contact.

Easier storage. TECO cluster mounting brackets can be stacked on top of each other—require only a minimum of storage space.

For more information about TECO thru-bolt brackets—your best answer for cluster transformer mounting-write today to:

TURNER ELECTRIC CORP.
9510 St. Clair Avenue • E. St. Louis, Illinois

Complete line of air-break switches, dead-end band brackets, flexi-band and thru-bolt cluster transformer brackets.



Line Post

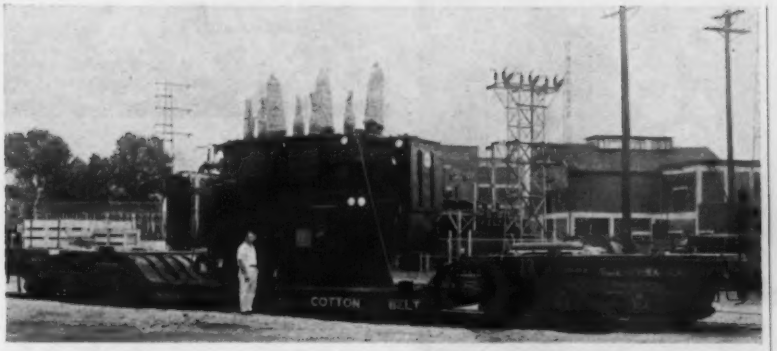
(25) *Ohio Brass Co., Mansfield, Ohio*

Said to make hot line work quick and convenient, this horizontal line post has an entirely new clamp design. The new clamp consists of a saddle which is supported on its base by two pintles, one fixed and the other in the form of a pintle bolt.

The manufacturer states that in addition to eliminating cost of crossarms and associated hardware, horizontal post construction is adaptable to narrow right-of-way, permits longer spans in certain applications and lowers maintenance cost.

(26) HYDRAULIC DERRICK—Engineered to withstand abuse in the field, the series 3750 hydraulic derrick features rectangular side legs and an extra long middle leg hydraulic cylinder. The new side legs are stronger than the tubular side legs used on series 3700—an earlier Holan model. A sturdy cross support between the derrick legs adds strength and rigidity. The middle leg hydraulic cylinder allows the derrick head to come closer to the ground and forces the digger deeper into the soil than was possible with the series 3700. Holan Corp., 4100 W. 150th St., Cleveland 35, Ohio.

(See Coupon on p 121)



Transformer

(27) *Moloney Electric Co., St. Louis 20, Mo.*

This 25-mva, 115-kv LTC transformer was designed to eliminate much of the labor costs incurred by a West Coast utility in moving transformers from one site to another. According to the manufacturer, the size of the unit is such that it may be transported between installation sites without being disassembled to meet freeway clearances. In addition to eliminating labor costs involved in assembly and disassembly, the task of relocating transformers is greatly expedited, the manufacturer states. Dimensions of this transformer permitted shipment completely assembled, except for lightning arresters and brackets.

High-Temperature Ballasts

(28) *General Electric Co., 1 River Road, Schenectady 5, N. Y.*

A new high-temperature mercury-lamp ballast, designed primarily for high-bay lighting applications, has been introduced by the General Electric Co.

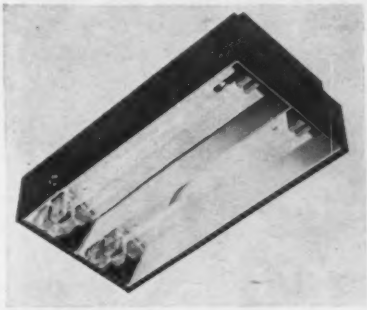
These new high-temperature ballasts can be mounted in areas that have much higher than normal ambient temperatures. Ballasts are suitable for use with mercury lamps installed in steel mills, foundries, forge rooms, boiler rooms and other typical, high-ambient locations.

Reflector

(29) *Quadrangle Mfg. Co., 32 S. Peoria St., Chicago 7, Ill.*

A new line of etched Alzak aluminum reflectors designed for high and medium mounting comes in 16- and 18-in. diameters. They conform to RLM Standard 40 and are available with socket type or exclusive Quad Easy-Tach construction for pendant or box-type mounting. They have interchangeable hoods that are varied in length for positioning the light source correctly in each size reflector.

Hoods are finished in gray porcelain enamel. White hoods are also available for use with the gray ones for keying units when used in twin mounting in combination installations of mercury vapor and incandescent lamps. Glass covers come for both 16- and 18-in. reflectors.



Infrared Heating

(30) *Luminator Inc., 120 N. Peoria St., Chicago 7, Ill.*

Development of new infrared heating units especially designed to make reflected radiant heating practical for almost all indoor and outdoor, open-area applications has been announced by Luminator.

The new heating units are designed with highly efficient reflectors for use with General Electric T-3 tubular quartz infrared lamps having filament temperatures in excess of 4,000 F. These infrared lamps convert approximately 85% of their energy into radiant heat similar to that of the sun. The warmth projected can be compared to that of the sun's rays when stepping from the shade into sunlight on a cool day.

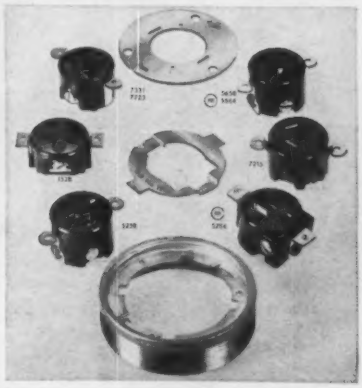
Use coupon on p 121

Latrobe

"UNLOCK" the source. Receptacle source now the DISTRIBUTOR'S SHELVES with these popular standards' ability to be "LAID-IN"

FULLMAN'S Adjustable STEEL BOX

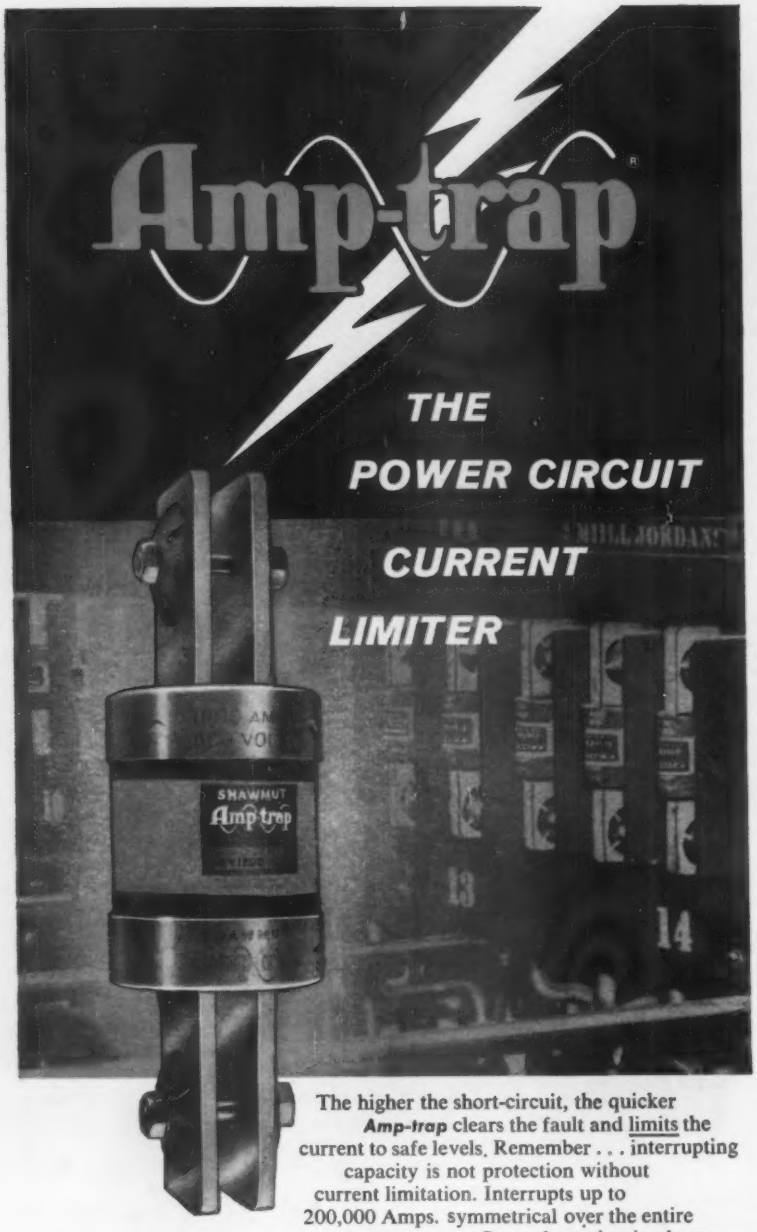
190 Series of N R (No Receptacle) Boxes



TO INSTALL—You simply drop the round KEY into slots in adjusting ring—"LAY-IN" receptacle you select and "LAY-ON" receptacle ring—that's all—very simple operation.

Sales Representatives in all principal Cities

Fullman
MANUFACTURING COMPANY
1209-1215 JEFFERSON ST.
LATROBE, PENNSYLVANIA



The higher the short-circuit, the quicker ***Amp-trap*** clears the fault and limits the current to safe levels. Remember . . . interrupting capacity is not protection without current limitation. Interrupts up to 200,000 Amps. symmetrical over the entire Ampere range. Stops short circuits short. Anticipates and prevents destruction before it can occur. Faster than any ordinary fuse.

Use ***Amp-trap*** on all general power circuits, DC circuits, Networks, Entrance Switches, Busways, etc. Be safe, not sorry — ask for, get and install ***Amp-trap***.

There is one for every purpose. Write today.

Amp-trap® – *"Awake At The Switch"*

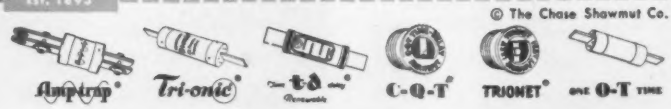
THE **CHASE-SHAWMUT CO.**

374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

Subsidiary of I-T-E CIRCUIT BREAKER CO.

REGISTERED U.S. PATENT OFFICE Est. 1893

© The Chase Shawmut Co. 1960



BULLETINS ETC.

(31) LIGHTING STANDARDS—Detailed data on Pfaff & Kendall lighting standards are contained in a 16-page catalog with more than 20 drawings. Luminaire specifications, arms, bases, anchorage, etc., are included. The catalog is cross indexed so that when a luminaire is under consideration loading factors may be determined and the correct lighting standard selected. Catalog ALS-5 is available from the manufacturer at 84 Foundry St., Newark, N. J.

(32) FIXTURES—Moe Light Division has prepared a four-page brochure describing a new line of slimline and strip line fluorescent lighting fixtures. Included is a new all-level dimmer for either fluorescent or incandescent installations. This strip lighting catalog may be secured from the Advertising Department, Moe Light Division of Thomas Industries Inc., 207 E. Broadway, Louisville 2, Ky.

(33) LIGHTING LAYOUTS — General Electric Co., Schenectady 5, N. Y., has issued a series of easy lighting layouts for various installations. Included are loading docks, materials handling, poster panels and highway signs, sports areas, football fields and building facades.

(34) GUIDE—For use of buyers, specifiers and sellers an answer guide to RLM-labeled industrial lighting equipment is designed to answer questions concerning the RLM label and program. The six-page answer guide reviews the many factors related to selection of quality lighting equipment. Write RLM Standards Institute, 326 W. Madison St., Chicago, Ill.

(35) WALL LIGHTING—A line of fluorescent linear wall lighting is described in a new brochure from Prescolite Mfg. Corp., Berkeley, Calif.

(36) FIXTURES—The Light Idea—New Custom Creations shows three new series of fixtures announced by Virden Lighting Division, John C. Virden Co. They are the Sun'N Sand, the Florentine and the Planter series. This brochure may be secured from local Virden distributors or direct from the manufacturer at 5209 Euclid Ave., Cleveland 3, Ohio.

(37) LUMINAIRES — Application and technical data on the new Trend series luminaires for schools and offices are contained in a bulletin from Lighting Products Inc., Highland Park, Ill.

(38) HANDBOOK—Progress Mfg. Co. is offering a 36-page, pocket-size handbook giving new home lighting ideas from the drawing boards of designers and architects. Copies may be secured from Progress Mfg. Co. Inc., Philadelphia 34, Pa.

(39) TIPS FOR SALES—Addressed to electrical contractors, a new booklet tells how G-E's lamp plan builds sales and profits. This booklet includes tips on how contractors can build the entire contracting business through selling lamps, as well as specific data on the G-E Lamp Agency Plan; lighting maintenance and group relamping sales opportunities; the lighting

market's growth potential for electrical contractors. The booklet is available through local G-E Large Lamp Department sales offices or from General Electric Co., Department LAP-5, Nela Park, Cleveland 12, Ohio.

(40) RECESSED FIXTURES — The Calculite group of recessed incandescent fixtures is described in a 36-page booklet issued by Lightolier, 346 Claremont Ave., Jersey City 5, N. J. Details are given for concentrated, medium and widespread beams; round and square units for use with general service and PAR lamps, 30 to 300 w.

(41) TRAFFIC SIGNAL CONTROL — A school signal system with electronic controller, designed for operation at midblock crossings, is described in bulletin 2716 from Crouse-Hinds Co., Syracuse 1, N. Y. The system is designated PA-300.

(42) GUIDE — Fluorescent Lamp Ballast Buyer's Guide, ATC-110, is available from Advance Transformer Co., 2950 N. Western Ave., Chicago 18, Ill. This guide has been expanded to include new listings.

(43) LUMINOUS CEILING — A brochure describing the recently developed Leaf-Lite luminous ceiling is offered by Luminous Ceilings Inc., 3701 N. Ravenswood Ave., Chicago 13, Ill.

(44) TREEGUARD — An expanded catalog of its complete line of plastic treeguards for protection of overhead lines has been issued by the Fanner Mfg. Co., Electrical Products Division, Brookside Park, Cleveland 9, Ohio.

(45) SUBSTATIONS — Aid in planning articulated unit substations for secondary distribution is given in a workbook released by Pennsylvania Transformer Division, McGraw-Edison Co., Canonsburg, Pa. Ratings, weights and dimensions are included and types of load centers and substations are described. Specifications are given for incoming supply sections, transformer sections and outgoing feeder assemblies, both indoor and outdoor.

(46) TAPING—"Useful Tips for Top Savings and Service" covers 24 tape jobs from protecting electrician's tools to use of color-coded tapes. The 12-page booklet is available from Johns-Manville, Dutch Brand Division, 7800 S. Woodlawn Ave., Chicago 19.

(47) CIRCUIT BREAKER — Federal Pacific Electric has issued bulletin 1425 on its new rotary handle circuit breakers and their use in switchboards, control centers, panelboards and enclosed circuit breakers. The complete line from 15 amp through 800 amp is described in this bulletin, available from the manufacturer at 50 Paris St., Newark 1, N. J.

(48) PRICE SHEET—Petersen Engineering Co., Santa Clara, Calif., has issued new price sheets on PENGO tension stringing equipment.

(49) SWITCH — Its new universally adaptable type DS distribution switch is described by I-T-E Circuit Breaker Co., Greensburg Division, in bulletin 1030A. Copies are available from I-T-E representatives.

(50) LIGHTNING ARRESTERS — Type F intermediate-class lightning arresters are the subject of bulletin LA4 offered by Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis. Type F arresters are offered in standard voltage ratings from 20 through 121 kv.

KILL TWO BIRDS WITH ONE STONE—Fill out this coupon and get back valuable information from as many sources as you indicate.

ELECTRICAL WEST
68 Post St., San Francisco 4, Calif.

Not good after November 1

Please send me, without obligation, the new product information or catalogs.

If described in Product News, circle item number

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

If described in advertising, fill in page number

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

NAME ..... TITLE .....

COMPANY .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

*Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.

KLEINS
for LINEMEN and ELECTRICIANS

The Original Klein Side Cutting Plier—Also available in NE (Streamlined) type. Cat. No. 201

High Leverage Plier—Extra high leverage permits cutting extremely tough wire. Also available in the standard type as shown above. Cat. No. 213-9NE

High Leverage Oblique Cutting Plier—A recently introduced plier designed to cut toughest wire. Cat. No. 228-8

Electrician Conduit Plier—Reams inside and outside of conduit, tightens lock nuts in outlet boxes. Cat. No. 333-8

"Since 1857" the name Klein has stood for the finest in tools and equipment for linemen and electricians. It is the uncompromising high quality back of the name Klein that has won Klein Pliers their place in the hands of men who know good tools. Klein Pliers are now available in a wider variety of styles and sizes than ever before. Be sure the pliers you need carry the Klein trade-mark.

Klein Catalog Free—This new Klein catalog giving complete information on Klein tools and equipment for linemen and electricians will be sent on request. Write for your copy.

Ask Your Supplier—Foreign Distributor: International Standard Electric Corp., N.Y.

Mathias KLEIN & Sons
Established 1857
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

GIBBONS
Power Connectors and Bus Fittings
for COPPER or ALUMINUM
51 Styles 600 Sizes

Made in The West
Send for Catalog
GIBBONS ELECTRIC COMPANY
P. O. Box 63, SANTA CLARA, CALIF.
CHerry 3-6698 918 DiGiulio Ave.
Successors to bus fitting activity of Federal Pacific Electric Co.

for the LONG PULL use
Y-ER EAS
Wire Pulling Lubricant
Only Y-ER EAS has all these features
Write for descriptive booklet

- Creamy, non-corrosive lubricant. Never greasy or messy.
- Prevents sticking or setting. Specially helpful on saddles and turns.
- Does not run back on cables.
- Never harmful to hands or clothing.
- Permanently non-harmful to cables or conduit.

GIVES THE SLIP TO—
Lead, Rubber, Braid or Synthetic Covered Cables
At All Leading Electrical Supply Houses
ELECTRO COMPOUND CO.
4148 W. 150th St., Cleveland 35, Ohio

PROPOSED WESTERN PROJECTS

Rocky Mountain

Between Artesia and Roswell, N. M., Aztec Pipeline Co., 36-mile jet fuel pipeline, $540,000.

Clovis, N. M., Swift & Co., meat packing plant, $1,000,000.

Albuquerque, N. M., Lytle Corp., research development center, $700,000. Plans by Ferguson, Stevens, Mallory & Pearl.

Boulder, Colo., University of Colorado, Memorial Center addition, $726,000. Plans by Trautwein & Howard, Philadelphia.

Ft. Collins, Colo., Colorado State University, classroom and office, $1,000,000; Humanities Building, $700,000. Plans by James M. Hunter & Associates, Boulder.

Denver, Colo., Gerald L. Schlessman, 10-story apartment, over $400,000. Plans by Eugene D. Sternberg & Associates.

Walden, Colo., North Park School District, high school, $750,000. Plans by Wheeler & Lewis, Denver.

Yellowstone National Park, Wyo., National Park Service Department, building and utilities, $1,421,600; bridges, minor roads and trails, $2,359,700.

Grand Teton National Park, Wyo., National Park Service Department, buildings and utilities, $343,300; minor roads and trails, $170,000.

Casper, Wyo., Nicolayesen Lumber Co., 11-story office building, $1,000,000. Plans by Goodrich & Wilking.

Big Piney, Wyo., Sublette County Board of Education, elementary school and additions, alterations to high school, $700,000. Plans by Kellogg & Kellogg, Cheyenne.

Rock Springs, Wyo., and Provo, Utah, Colorado Interstate Gas Co., 155-mile pipeline, $92,829,566. Plans at company's Colorado Springs office.

Hawaii and Alaska

Mt. McKinley National Park, Alaska, National Park Service Department, park roads, $562,500 and $187,500.

Palmer, Alaska, Matanuska Electric Assn., distribution lines, tie lines and substation, $1,212,000.

Spenard, Alaska, Anchorage Natural Gas Corp., office building, $400,000. Plans by Manley & Meyer, Anchorage.

Anchorage, Alaska, Alcan Pacific Co., 33 homes, $1,000,000.

Hickman Field, Hawaii, U. S. Engineers, operational facilities, $265,000.

Barber's Point, Oahu, Hawaii, 14th Naval District, operational facilities, $222,000.

Kaneohi, Hawaii, 14th Naval District, operational facilities, $397,000.

Pearl Harbor, Hawaii, 14th Naval District, training facilities, $509,000.

Kamaole, Kihei, Hawaii, Canadian developers, Chris Engel and Steve Predy, 2-story hotel, $1,500,000.

Waimalu, Hawaii, Snowflake Bakery of Hawaii, bakery plant, $1,000,000.

Pacific Southwest

Petrified Forest National Monument, Ariz., National Park Service Department, buildings and utilities, $803,000.

Whiteriver, Ariz., School District No. 20 of Mavajo County, elementary school, $788,128.

Point Mugu, Calif., 11th Naval District, 300-unit housing, $3,000,000.

Santa Barbara, Calif., Encore Homes No. 2 Inc., 48 dwellings, $685,000.

Pasadena, Calif., National Aeronautics & Space Administration, modernization laboratory facilities, $2,335,300; solid propellant facility, $1,954,700; liquid propellant test cell, $500,000.

Santa Maria, Calif., Santa Maria Joint Union High School, high school, $2,750,000. Plans by H. L. Gogerty, Los Angeles.

Los Angeles, Calif., Los Angeles Board of Education, school, $550,000. Plans by Thormin & Haynes.

San Diego, Calif., San Diego Unified School District, senior high school, Clairemont, $2,500,000. Plans by Wulff & Fifield.

Los Angeles, Calif., David Shussett Inc., 35-story office building, $20 million. Plans by Charles Luckman Associates.

Covina, Calif., high school, $2,500,000. Plans by H. L. Gogerty, Los Angeles.

March Air Force Base, Calif., U.S. Engineers, operational facilities, $7,428,000.

Vandenberg Air Force Base, Calif., U. S. Engineers, maintenance facilities, $1,284,000.

Oxnard, Calif., U. S. Engineers, maintenance community facilities, $732,000.

Pacific Northwest

Skaggs Island, Calif., 12th Naval District, naval radio station, $1,579,000.

Marysville, Calif, Yuba County court house, $2,500,000. Plans by Harold M. Hansen, San Francisco.

Hanford, Calif., Dominican Sisters of the Third Order of St. Dominic, 3-story hospital, $2,500,000. Plans by Maguolo & Quick & Frank W. Trabucco, San Francisco.

Del Paso Heights, Calif., Grant Union High School District, senior high school, Rio Linda, $2,480,000. Plans by Starks, Jozens & Nacht, Sacramento.

Reno, Nev., University of Nevada, 3-story College of Agriculture building, $852,000. Plans by Edward Parsons.

Reno, Nev., Washoe County civic auditorium, $3,000,000. Plans by Richard Neutra.

Las Vegas, Nev., U. S. Engineers, Nellis Air Force Base maintenance facilities, $2,223,000.

Lake Mead National Recreation Area, Nev., National Park Service Department, buildings and utilities, $262,600.

Oceanlake, Ore., Oregon Senior Citizens of Oceanlake Inc., 10-story retirement apartment and 60 single-story buildings, $3,000,000. Plans by Leslie Poole, Portland.

Cle Elum, Wash., School District No. 104, high school, $750,000.

Yakima, Wash., School District No. 7, stadium, auditorium and athletic field for six schools, $5,600,000.

Olympic National Park, Wash., National Park Service Department, buildings and utilities, $327,100.

Dayton, Wash., School District No. 2, school, $400,000. Plans by J. S. Villesvik, Yakima.

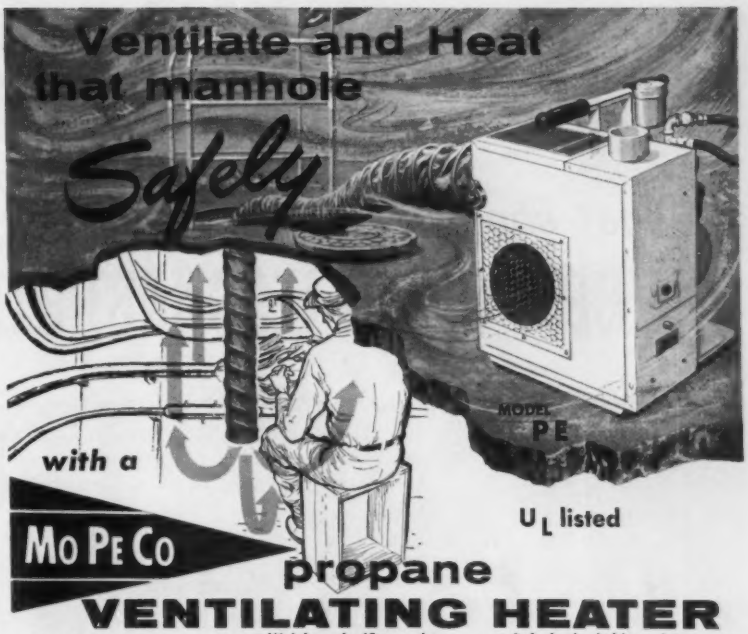
Vancouver National Monument, Wash., National Park Service Department, buildings and utilities, $256,100.

Moses Lake, Wash., U. S. Engineers, operational facilities, $1,282,000.

Arco, Idaho, technical center, national reactor testing station, $1,000,000. Plans by Kobig & Kobig, Los Angeles.

Idaho Falls, Idaho, hospital additions, $1,237,000. Plans by Jackson Sharp & Collard, Salt Lake City.

San Francisco, Calif., 169-unit apartment, Western Development, $2,000,000. Plans at Skidmore, Owens & Merrill; 100-unit circular apartment, $200,000,000. Plans at Donald Powers Smith; 300-unit apartment, $6,000,000. Plans by Marquis & Stoller.



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In discussing the easy wire pulling qualities of ELECTRUNITE's exclusive "INSIDE-KNURLING", Ray said: *"Pulling a pair of #8's and a #10 over tight bends is a lot easier with the Silverslick inside finish. You can feel the difference."*

Buy and try Republic ELECTRUNITE E.M.T. on your next job. These ease of installation advantages can be yours. Call your Republic representative. Or, write direct.

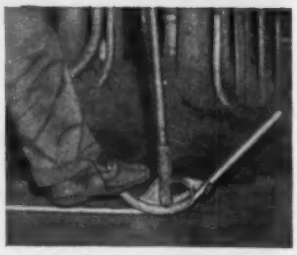
REPUBLIC STEEL

STEEL AND TUBES DIVISION

Cleveland 8, Ohio

REPUBLIC ELECTRUNITE® E.M.T. is produced from highest quality flat-rolled, open-hearth steel, controlled by Republic through every step of manufacturing from ore to finished product. ELECTRUNITE E.M.T. was used in the construction of the new Y.M.C.A. Building, Racine, Wisconsin. Architects: Grassold-Johnson, Associates, Racine, Wisconsin. Electrical Contractor: Dave Speaker Company, Kenosha, Wisconsin.

"We needed a 14-inch right angle bend so that there would be enough stubbing after the concrete pour. "INCH-MARKS" make it easy. Just check off 14" and subtract the bender allowance. Put the bender on the mark and zingo, she's done." That's the way Ray Kunkle describes ELECTRUNITE's "INCH-MARKED"® and "GUIDE-LINED"® features.



ELECTRUNITE's tightly adhering galvanized coating protects against corrosion—won't peel, chip, or flake off during bending. Resists galvanic action. Millions of feet have been successfully used in slab concrete installations over the past twenty-five years. Still in service, ready for more service tomorrow.

Estimator's Guide

Prices shown are for new construction cost in place. Quotations furnished by LeRoy Construction Service

As a service to its readers, Electrical West is pleased to add the Estimator's Guide beginning with this issue.

The figures in this guide, furnished by LeRoy Construction Service, will be kept up to date and published periodically.

This guide is for your use. Will you please let the editor know if there are other figures or ideas which would make this section more valuable to you?

Residential Wiring

PER OUTLET, 120 V—2 WIRE

Knob & tube	Each	8.50
Nonmetallic cable	Each	8.00
Armored cable (BXL)	Each	16.00
EMT	Each	20.00
Conduit rigid	Each	23.00

PER OUTLET, 230 v—3 Wire (RANGE—OVEN—WALL HEATER)

Nonmetallic cable (Romex)	Each	14.00
Flex conduit (Greenfield)	Each	22.00
EMT	Each	23.00

SERVICE & PANEL

Light panel & service	
50 amp lugs 120/240 v—3 wire	
4 1 pole circuit, 15 amp fused	70.00
Light panel & service	
100 amp ACB 120/240 v—3 wire	
4 1 pole circuit, 15 amp	
2 2 pole circuit, 20 to 50 amp	150.00
Light panel & service	
100 amp—ACB 120/240 v	
6 1 pole circuit, 15 amp	
3 2 pole circuit, 20 to 50 amp	165.00
Light panel & service	
100 amp—ACB 120/208 v, 3 phase, 4 wire	
8 1 pole circuit, 15 amp	
2 2 pole circuit, 20 to 50 amp	
2 3 pole circuit, 15 to 30 amp	225.00
(Required for air conditioning system)	

INSTALL LIGHT FIXTURES (Fixtures Purchased on Allowance)

Incandescent	Each	4.00
Fluorescent	Each	5.00
Yard light	Each	5.00
Bathroom exhaust fan	Each	50.00
Garden pedestal light fixture	Each	40.00

Commercial Wiring—Conduit

RIGID GALVANIZED

	Per C
½"	49.00- 54.00
¾"	62.00- 68.00
1"	79.50- 87.00
1¼"	103.00-115.00
1½"	121.50-132.00
2"	160.00-175.00
2½"	229.00-252.00
3"	298.50-325.00
3½"	365.50-401.00
4"	417.50-456.00
5"	624.50-685.00

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Commercial Wiring—EMT

	Per C
½"	34.50- 38.00
¾"	43.50- 48.00
1"	58.00- 64.00
1½"	83.00- 90.00
1¼"	70.50- 76.00
2"	103.00-112.00

Commercial Wiring—RHW

WIRE 600 V—75°

	Per M
750 mcm, stranded	2,011.00-2,090.00
700 mcm, stranded	1,867.00-1,940.00
600 mcm, stranded	1,675.00-1,742.00
500 mcm, stranded	1,401.00-1,457.00
400 mcm, stranded	1,140.00-1,185.00
300 mcm, stranded	923.00- 960.00
250 mcm, stranded	830.00- 860.00
No. 4/0, stranded	690.00- 717.00
No. 3/0, stranded	567.00- 589.00
No. 2/0, stranded	451.00- 965.00
No. 1/0, stranded	378.50- 393.00
No. 1, stranded	322.50- 335.00
No. 2, stranded	240.00- 249.00
No. 4, stranded	182.50- 190.00
No. 6, stranded	137.00- 142.00
No. 8, stranded	106.50- 110.00
No. 10, stranded	80.50- 83.00
No. 12, stranded	66.00- 68.00
No. 14, stranded	57.00- 59.00
No. 8, solid	99.00- 102.00
No. 10, solid	75.00- 78.00
No. 12, solid	61.00- 63.00
No. 14, solid	52.50- 54.00

Commercial Wiring—TW

WIRE 600 V—75°

	Per M
750 mcm, stranded	1,850.00-1,924.00
600 mcm, stranded	1,537.00-1,598.00
500 mcm, stranded	1,300.00-1,350.00
400 mcm, stranded	1,017.00-1,057.00
300 mcm, stranded	850.00- 882.00
250 mcm, stranded	750.00- 780.00
No. 4/0, stranded	635.50- 660.00
No. 3/0, stranded	543.00- 564.00
No. 2/0, stranded	432.50- 449.00
No. 1/0, stranded	356.50- 370.00
No. 1, stranded	306.00- 318.00
No. 2, stranded	227.00- 236.00
No. 4, stranded	173.00- 179.00
No. 6, stranded	129.50- 134.00
No. 8, stranded	95.00- 98.00
No. 10, stranded	73.00- 75.00
No. 12, stranded	39.50- 41.00
No. 14, stranded	51.50- 53.00
No. 8, solid	87.00- 90.00
No. 10, solid	68.00- 70.00
No. 12, solid	55.00- 57.00
No. 14, solid	47.50- 49.00

Commercial—Outlets & Connections

Conduit and wire not included

	Each
Light fixture outlet	
Recess	8.00
Surface	7.00
WP	8.00
Duplex outlet	
15 amp	9.00
15 amp WP	10.00
Clock outlet	9.00
Floor outlet, flush	17.00
Floor outlet, pedestal type	23.00
Outlet, 240 v, 3 wire, 1 phase, 30 to 50 amp	13.00
Outlet, 240 v, 4 wire, 3 phase, 30 to 50 amp	15.00
Switch, single pole	9.00
Switch, double pole	10.00
Switch, 3 way	10.00
Switch, single pole w/pilot	12.00
Switch, momentary contact	10.00

Motor Outlet & Connection

GREENFIELD FLEXIBLE CONDUIT

	Each
Fractional hp, 120 v, 1 phase	11.00
Fractional to 3 hp, 240 v, 3 phase	13.00
5 to 10 hp, 240 v, 3 phase	14.50
15 to 25 hp, 240 v, 3 phase	18.00
30 to 50 hp., 240 v, 3 phase	26.50
60 to 100 hp, 480 v, 3 phase	35.00
For Sealtite add 25%	
For explosionproof add 50%	

Power & Control Equipment

MOTOR DISC. SWITCH TYPE C NONFUSIBLE STD. DUTY 250 V

	Each
30 amp, 2 pole, 240 v	19.00
30 amp, 3 pole, 240 v	21.50
60 amp, 3 pole, 240 v	34.00
100 amp, 3 pole, 240 v	52.00
200 amp, 3 pole, 240 v	84.50
400 amp, 3 pole, 240 v	178.00
600 amp, 3 pole, 240 v	280.00
30 amp, 3 pole, 575 v	22.00
60 amp, 3 pole, 575 v	36.00
100 amp, 3 pole, 575 v	54.00
200 amp, 3 pole, 575 v	88.00
400 amp, 3 pole, 575 v	184.00
600 amp, 3 pole, 575 v	290.00

PUSHBUTTON STATION

NEMA 1, std. duty	
One button	14.50
Two button	17.00
Three button	22.50
NEMA 1, heavy duty	
One button	20.00
Two button	27.00
Three button	34.00
NEMA 4 & 5, std. duty	
One button	32.50
Two button	34.00
Three button	38.50
NEMA 4 & 5, heavy duty	
One button	37.50
Two button	42.50
Three button	61.00

MOTOR STARTERS—MANUAL

Size 00—1 pole, 120/208 v	17.00
Size 00—2 pole, 240/480 v	19.00
Size 0—2 pole, 240/480 v	32.00
Size 1—2 pole, 240/480 v	37.00
Size 0—3 pole, 240/480 v	41.00
Size 1—3 pole, 240/480 v	46.00

MOTOR STARTERS—MAGNETIC RESET ONLY IN COVER

Size 0—2 pole, single phase	47.00
Size 1—2 pole, single phase	52.00
Size 1½—2 pole, single phase	67.00
Size 0—3 pole, 3 phase	55.00
Size 1—3 pole, 3 phase	60.00
Size 2—3 pole, 3 phase	107.00
Size 3—3 pole, 3 phase	173.00
Size 4—3 pole, 3 phase	365.00

MOTOR STARTERS—MAGNETIC START, STOP, RESET IN COVER

Size 0—2 pole, single phase	56.00
Size 1—2 pole, single phase	62.00
Size 1½—2 pole, single phase	77.00
Size 0—3 pole, 3 phase	63.00
Size 2—3 pole, 3 phase	68.00
Size 2—3 pole, 3 phase	116.00
Size 3—3 pole, 3 phase	183.00
Size 4—3 pole, 3 phase	374.00

UNDERFLOOR DUCT SYSTEM

Duct, No. 2, single run, including junction boxes and misc. ftgs., etc.	Per ft 2.90
Duct No. 4, single run, including junction boxes and misc. ftgs, etc	Per ft. 3.20
Pedestal underfloor duct outlet, power	Each 16.50
Pedestal underfloor duct outlet, telephone	Each 14.00

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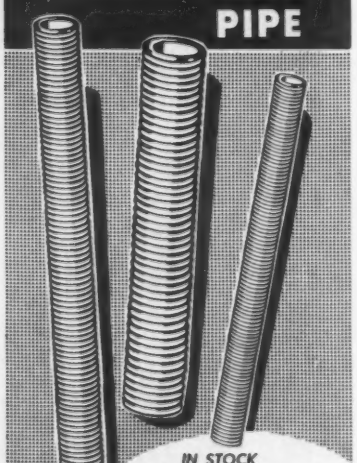

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⅛" to 6" sizes • 3 ft. lengths

Raw black

Raw black, threads electro-galvanized

Hot galvanized, threads electro-galv.

5

CONDUIT NIPPLE MFG. CO.

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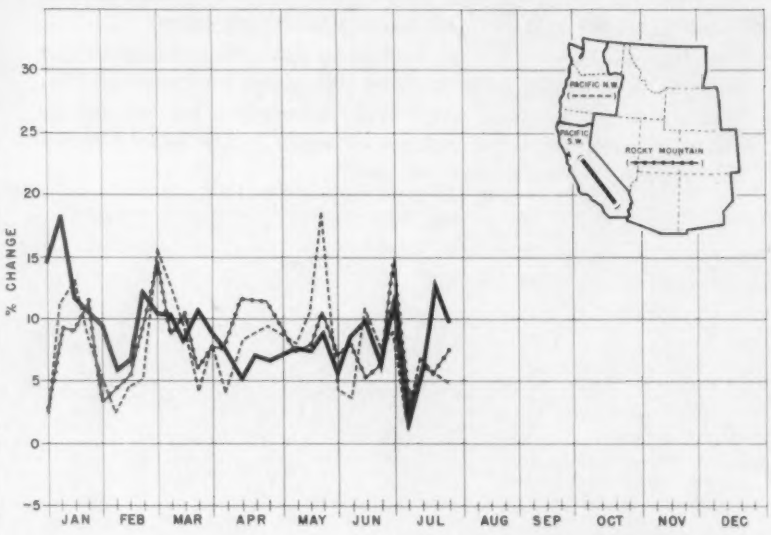
WESTERN BUSINESS INDICATORS

Output Comparisons

Year-to-year Kwh Output Changes. Per Cent Change Over Same Week One Year Ago for Regions as Indicated in Keyed Map



Electrician's Union Hourly Wage Scale

WESTERN ECONOMY AT A GLANCE

Year Ago	Last Month	This Month
5,351.6	5,800.5	5,774.8

Personal income in millions — seasonally adjusted as of August 15th

76,598	78,512	78,956

Nonfarm employment in thousands

18,848	18,977	18,946

Manufacturing employment in thousands

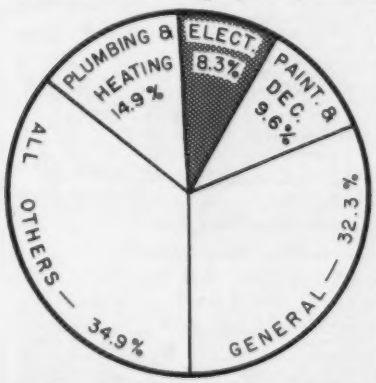
39.9	28.7	29.6

Housing starts—thousands of units

25,905	32,051	32,189

Industrial building contracts—thousands of dollars

Distribution of Employees by Trade



Sources: Business Week, Bureau of Labor Statistics, Construction Daily and Engineering News-Record

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If you have the above qualifications and are willing to travel, a progressive West Coast manufacturer whose products are leaders in their field used by power and telephone companies has an opening in the Southwestern States which includes California, Arizona, Utah, and Nevada with headquarters in or about the metropolitan area of Los Angeles. Salary, Expenses and incentive bonus. Also many company benefits. If this interests you, write for an interview.

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68 Post Street, San Francisco 4, Calif.

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Top calibre salesman. 30, Married, 5 years' electrical experience. B.A., plus supplemental engineering background. Seeks position in California with electrical equipment manufacturer. Write Box 316, **Electrical West,** San Francisco 4, Calif.

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Medina, Wash.: Lyle Heaton ..... GL 4-8696
Albuquerque ..... CHapel 2-8626

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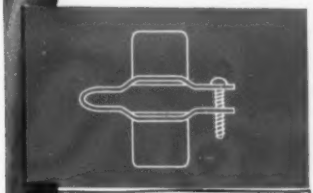

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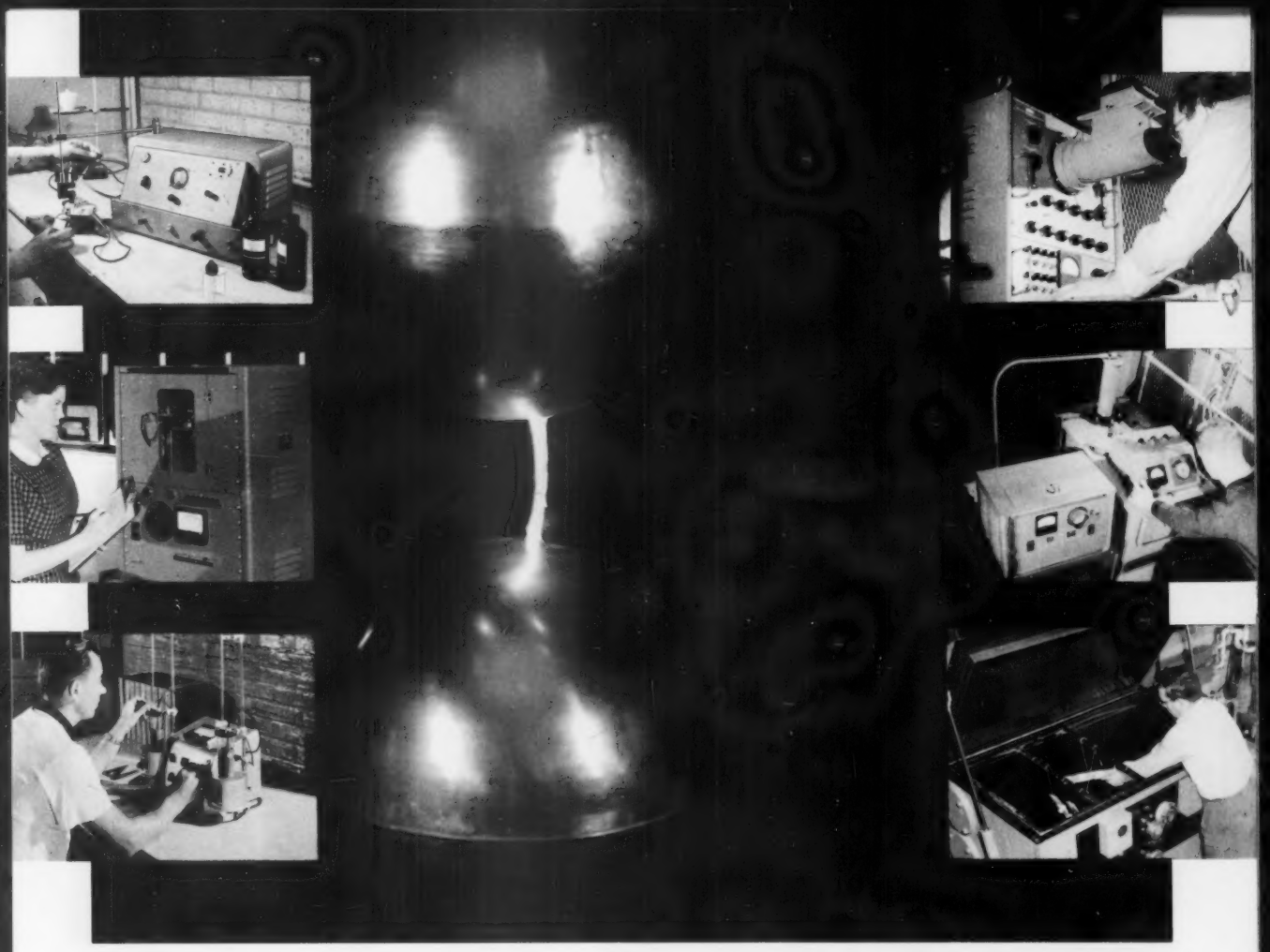

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